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STUDIES OF CHILDHOOD.

VIII.—FEAR.

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IN passing from a study of children's ideas to an investigation of their feelings we seem to encounter quite a new kind of problem. A child has the germs of ideas long before he can give them clear articulate expression; and, as we have seen, he has at first to tax his ingenuity in order to convey by intelligible signs the thoughts which arise in his mind. For the manifestation of his feelings of pleasure and pain, on the other hand, Nature has endowed him with adequate expression. The states of infantile discontent and content, misery and gladness, pronounce themselves with a clearness, with an emphasis, which leave no room for misunderstanding.

This full, frank manifestation of feeling holds good more especially of those states of bodily comfort and discomfort which make up the first rude experiences of life. It is necessary for the child's preservation that he should be able to announce by clear signals the oncoming of his cravings and of his sufferings, and we all know how well Nature has provided for this necessity. Hence the facility with which infant psychology has dealt with this first chapter of the life of feeling. Preyer, for example, gives a full and almost exhaustive epitome of the various shades of infantile pleasure and pain growing out of this life of sense and appetite, and has carefully described their physiological accompaniments and their signatures.*

* *Op. cit.*, cap. 6 and 13.

When we pass from these elementary forms of pleasure and pain to the rudiments of emotion proper—as the miseries of fear, the sorrows and joys of the affections—we have still, no doubt, to do with a mode of manifestation which, on the whole, is direct and unreserved to a gratifying extent. A child of three is delightfully incapable of the skillful repressions and the yet more skillful simulations of emotion which are easy to the adult. Yet, frank and transparent as is the first instinctive utterance of feeling, it is apt to get checked at an early date, giving place to a certain reserve. So that, as we know from published reminiscences of childhood, a child of six will have learned to hide some of his deepest feelings from unsympathetic eyes.

This shyness of the young heart, face to face with old and strange ways of feeling, exposed to ridicule if not to something worse, makes the problem of registering its pulsations of emotion more difficult than it at first seems. As a matter of fact, we are still far from knowing the precise range and depth of children's feelings. This is seen plainly enough in the quite opposite views which are entertained of childish sensibility, some describing it as restricted and obtuse, others as morbidly excessive. Such diversity of view may, no doubt, arise from differences in the fields of observation, since, as we know, children differ hardly less than adults, perhaps, in breadth and fineness of emotional susceptibility. Yet I think that such contrariety of view points further to the conclusion that we are still far from sounding with finely measuring scientific apparatus the currents of childish emotion.

It seems, then, to be worth while to look further into the matter in the hope of gaining a deeper and fuller insight; and as a step in this direction I propose to inquire into the various forms and the causes of one of the best-marked and most characteristic of children's feelings—namely, fear.

That fear is one of the characteristic feelings of the child needs no proving. It seems to belong to these wee, weakly things, brought face to face with a new, strange world, to tremble. They are naturally timid, as all that is weak and ignorant in Nature is apt to be timid.

I have said that fear is well marked in the child. Yet, though it is true that fully developed fear or terror shows itself by unmistakable signs, there are many cases where it is difficult to say whether the child is the subject of fear. Thus the reflex movement of a start on hearing a sound does not amount to fear, though it is akin to fear.* Again, a child may show a sort of æsthetic dislike for an ugly form or sound, turning away in evident aversion, and yet not be afraid in the full sense. Fear proper betrays

* For an account of this reflex, see Preyer, *op. cit.*, cap. 10, S. 176.

itself in the stare, the grave look, and in such movements as turning away and hiding the face against the nurse's or mother's shoulder. In severer forms it leads to trembling and to wild shrieking. Changes of color also occur. It is commonly said that great fear produces paleness; but, according to one of my correspondents, a child may show fear by his face turning scarlet. Fear, if not very intense, leads to voluntary movements—as turning away, putting the object away, or going away. In its more violent forms, however, it paralyzes the child. It is desirable that parents should carefully observe and describe the first signs of fear in their children.

It may be well to begin our study of fear by a reference to startling effects. As is well known, sudden and loud sounds, as that of a door banging, will give a shock to an infant in the first weeks of life, which, though not amounting to fear, is its progenitor. A clearer manifestation occurs when a new and unfamiliar sound calls forth the grave look, the trembling lip, and possibly the fit of crying. Darwin gives an excellent example of this. He had, he tells us, been accustomed to make all sorts of sudden noises with his boy, aged four months and a half, which were well received; but one day, having introduced a new sound—that of a loud snoring—he found that the child was quite upset, bursting out into a fit of crying.*

As this incident suggests, it is not every new sound which is thus disconcerting to the little stranger. Sudden sharp sounds seem to be especially disliked, as those of a dog's bark. Loud and voluminous sounds, too, have a terrifying effect. The big noise of a factory, of a steamship, of a passing train, are among the causes alleged by my correspondents of this early startling and terrifying effect. My little girl when taken into the country at the age of nine months, though she liked the animals she saw on the whole, showed signs of fear on hearing the bleating of the sheep, by seeking shelter against the nurse's shoulder. So strong is this effect of suddenness and volume of sound that even musical sounds often excite some alarm at first. "He (a boy of four months) cried when he first heard the piano," writes one lady, and this is but a sample of many observations. A child of five months and a half showed such a horror of a banjo that it would scream if it were played or only touched. Preyer's boy, at sixteen months, was apparently alarmed when his father, in order to entertain him, produced a pure musical tone by rubbing a drinking-glass. He remarks that this same sound had been produced when the child was four months old without any ill effects.†

This last fact suggests that such shrinkings from sound may

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* Mind, vol. ii, p. 288. † *Op. cit.*, p. 131.

be developed at a comparatively late date. This idea is supported by other observations. "From about two years four months (writes a mother) to the present time (two years and eleven months) he has shown signs of fear of music. At two years five months he liked some singing of rounds, but when a fresh person with a stronger voice than the rest joined, he begged the singer to stop. Presently he tolerated the singing as long as he might stand at the farthest corner of the room." This child was also about the same time afraid of the piano, and of the organ, when played by his mother in a church.

It is sometimes supposed that this startling effect of loud sounds is wholly an affair of nervous disturbance.* But the late development of the repugnance in certain cases seems to show that this is not the only cause at work. Of course, a child's nervous organization may, through ill health, become more sensitive to this disturbing effect. But I suspect that vague alarm at the unexpected and unknown takes part here. There is something uncanny to the child in the very production of sound from a usually silent thing. A banjo lying now inert, harmless, and then suddenly firing out a whole gamut of sound may well shock a small child's preconceptions of things. The second time that fear was observed in our child at the age of ten months it was excited by a new toy which squeaked on being pressed.† This seems to be another example of the disconcerting effect of the unexpected. In other cases the alarming effect of the mystery is increased by the absence of all visible cause. One little boy of two years used to get sadly frightened at the sound of the water rushing into the cistern which was near his nursery. The child was afraid at the same time of thunder, calling it "water coming."

I am far from saying that all children manifest this fear of sounds. Miss Shinn points out that her niece was from the first pleased with the piano, and this is no doubt true of many children. Children behave very differently toward thunder, some being greatly disturbed by it, others being rather delighted. Thus Preyer's boy, who was so ignominiously upset by the tone of the drinking-glass, laughed at the thunderstorm; and we know that the little Walter Scott was once found during a thunderstorm lying on his back in the open air clapping his hands and shouting "Bonnie, bonnie!" at the flashes of lightning. It is possible that in such cases the exhilarating effect of the brightness counteracts the uncanny effect of the thunder. More observations are needed on this point.

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* This seems to be the view of Perez: The First Three Years of Childhood (English translation), p. 64.

† Observation of F. H. Champneys. Mind, vol. vi, p. 106.

A complete explanation of these early vague alarms of the ear may as yet not be possible. Children show in the matter of sound capricious repugnances which it is exceedingly difficult to account for. They seem sometimes to have their pet aversions like older folk. But I think a general explanation is possible.

To begin with, then, it is probable that in many of these cases, especially those occurring in the first six months, we have to do with an organic phenomenon, with a sort of jar to the nervous system. To understand this we have to remember that the ear is, in the case of man at least, the sense-organ through which the nervous system is most powerfully and profoundly acted on. Sounds seem to go through us, to pierce us, to shake us, to pound and crush us. A child of four or six months has a nervous organization still weak and unstable, and we should naturally expect loud sounds to produce a disturbing effect on it.

To this it is to be added that sounds have a way of taking us by surprise, of seeming to start out of nothing; and this aspect of them, as I have pointed out above, may well excite vague alarm in the small creatures to whom all that is new and exceptional is apt to seem uncanny. The fact that most children soon lose their fear by getting used to the sounds seems to show how much the new and the mysterious has to do with the effect.

Whether heredity plays any part here in the fear of the dog's barking and other sounds of animals seems to me exceedingly doubtful. This point will, however, come up for closer consideration presently, when we deal with children's fear of animals.

Before considering the manifold outgoings of fear produced by impressions of the eye, we may glance at another form of early disturbance which has some analogy with the shocklike effects of certain sounds. I refer here to the feeling of bodily insecurity which appears very early when the child is awkwardly carried, or let down back foremost, and later when it begins to walk. One child in her fifth month was observed, when carried, to hold on to the nurse's dress as if for safety. And it has been noticed by more than one observer that on dandling a baby up and down on one's arms, it will on descending—that is, when the support of the arms is being withdrawn—show signs of discontent in struggling movements.* Bell, Preyer, and others regard this as an instinctive form of fear. Such manifestations may, however, be merely the result of sudden and rude disturbances of the sense of bodily ease which attends the habitual condition of adequate support. A child accustomed to lie in a cradle, on the floor, or in somebody's lap, might be expected to be put out when the supporting mass is greatly reduced, as in bad carrying, or wholly removed, as

* See the quotation from Sir Charles Bell, Perez, First Three Years of Childhood, p. 63.

in quickly lowering the child backward. The fear of falling, which shows itself on the child's first attempting to stand, comes, it must be remembered, as an accompaniment of a new and highly strange situation. The first experience of using the legs for support must, one supposes, involve a profound change in the child's whole bodily consciousness—a change which may well be accompanied with a sense of disturbance. Not only so, it comes after a considerable experience of partial failings, as in trying to turn over when lying, half climbing the sides of the cradle, etc., and still ruder bumpings when the crawling stage is reached. These would, I suspect, be quite sufficient to produce the timidity which is observable on making the bolder venture of standing.*

Fears excited by visual impressions come later than those excited by sounds. The reason of this seems pretty obvious. Visual sensations do not produce the strong effect of nervous shock which auditory ones produce. Let a person compare the violent and profound jar which he experiences on suddenly hearing a loud sound with the slight surface agitation produced by a sudden movement of an object across the field of vision. The latter has less of the effect of nervous jar and more of the characteristics of fear proper—that is, vague apprehension of evil. We should accordingly expect that eye-fears would only begin to show themselves in the child after experience had begun its educative work.†

At the outset it is well, as in the case of ear-fear, to keep before us the distinction between mere dislike to a sensation and a true reaction of fear. We shall find that children's quasi-æsthetic dislikes to certain colors may readily simulate the appearance of fears.

Among the earliest manifestations of fear excited by visual impressions we have those called forth by the presentation of something new and strange, especially when it involves a rupture of customary arrangement. Although children love and delight in what is new, their disposition to fear is apt to give to new and strange objects a disquieting if not distinctly alarming character. This apprehension shows itself as soon as the child has begun to be used or accustomed to a particular state of things.

Among the more disconcerting effects of the ruder departure from the customary we have that of change of place. At first the infant betrays no sign of disturbance on being carried into a

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* Preyer seems to regard this as instinctive. *Op. cit.*, p. 131.

† M. Perez (*op. cit.*, p. 65) calls in the evolution hypothesis here, suggesting that the child, unlike the young animal, is so organized as to be more on the alert for dangers which are near at hand (auditory impressions) than for those at a distance (visual impressions). I confess, however, that I find this ingenious writer not quite convincing here.

new room. But when once it has grown accustomed to certain rooms it will feel a new room to be strange, and eye its features with a perceptibly anxious look. My little girl at the age of seven months and a third gave unmistakable signs of such vague apprehension on changing her abode—a change which involved that of human surroundings also. She looked about her half wonderingly, half timidly, struck by the strangeness of the scenery, of the faces, and of the voices. Later, when experience and imagination are added, a child will show a still more marked shrinking from strange rooms. Thus a boy retained up to the age of three years and eight months the fear of being left alone in strange hotels or lodgings. Yet entrance on a strange abode does not by any means always excite this reaction. A child may have his curiosity excited, or may be amused by the odd look of things. Thus one boy, on being taken at the age of fifteen months to a fresh house and given a small plain room, looked round and laughed at the odd carpet. Children even of the same age appear in such circumstances to vary greatly with respect to the relative strength of the impulses of fear and curiosity.

How different children's mental attitude may be toward the new and unfamiliar is illustrated by some notes on a boy sent me by his mother. This child, "though hardly ever afraid of strange people or places, was very much frightened as a baby *of familiar things seen after an interval.*" Thus "at ten months he was excessively frightened on returning to his nursery after a month's absence. On this occasion he screamed violently if his nurse left his side for a moment for some hours after he got home, whereas he had not in the least objected to being installed in a strange nursery." The mother adds that "at thirteen months, his memory having grown stronger, he was very much pleased at coming to his home after being away a fortnight." This case looks puzzling enough at first and seems to contradict the laws of infant psychology. Perhaps the child's partial recognition was accompanied by a sense of the uncanny, like that which we experience when a place seems familiar to us, though we have no clear recollection of having seen it before.

What applies to places applies also to persons; a sudden change of customary human surroundings by the arrival of a stranger on the scene is apt to trouble the child.

At first all faces seem alike to the child. Later, unfamiliar faces excite something like a grave inquisitorial scrutiny. Yet for the first three months there is no distinct manifestation of fear of strangers. It is only later, when attachment to human belongings has been developed, that the intrusion of strangers, and especially the proposal of a stranger to take the child, calls forth clear signs of displeasure and the shrinking away of fear.

Preyer gives the sixth and seventh month as the date at which his boy began to cry at the sight of a strange face. In one set of notes sent me it was remarked that a child four months and a half old would cry on being nursed by a stranger. To be nursed by a stranger, however, is to have the whole baby world revolutionized: little wonder, then, that it should bring the feeling of strangeness and homelessness (*unheimlichkeit*).

Here, too, curious differences soon begin to disclose themselves, some children being decidedly more sociable toward strangers than others. It would be curious to compare the age at which children begin to take kindly to strangers. Preyer gives nineteen months as the date at which his boy surmounted his timidity; but it is probable that the transition occurs at very different dates in the case of different children.

I should like to add that the little boy to whom I referred just now displayed the same signs of uneasiness at seeing old friends after an interval, as at returning to old scenes. When eight months old "he moaned in a curious way when his nurse (of whom he was very fond) came home after a fortnight's holiday." Here, however, the signs of fear seem to be less pronounced than in the case of returning to the old room. It would be difficult to give the right name to this curious moan.

Partial alteration of the surroundings frequently brings about a measure of this same mental uneasiness. C——'s disturbance at the age of twelve weeks at finding his mother in a new dress is paralleled by the apprehensions of Preyer's boy when one year and five months old on seeing his mother in a black dress. The second observation, read in the light of the first, seems to suggest that a change from the customary rather than anything appalling-looking in the black color itself was here the source of the boy's trouble.* This is borne out by another observation sent me. A child manifested between the ages of six or eight months and two years and a half the most marked repugnance to new clothes, so that the authorities found it very difficult to get them on. It is presumable that the donning of new apparel disturbed too rudely the child's sense of his proper self, and begot an uncanny feeling of another put in place of the old familiar child.

In certain cases the introduction of new natural objects of great extent and impressiveness will produce a similar effect of childish anxiety, as though they made too violent a change in the surroundings. One of the best illustrations of this obtainable from the life of an average well-to-do child is the impression produced by a first visit to the sea. Preyer's boy, at the age of

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* *Op. cit.*, p. 131. Compare the alarming effect of the father's putting on a big hat, p. 117.

twenty-one months, showed all the signs of fear when his nurse carried him on her arm close to the sea.* The boy C——, on being first taken near the sea at the age of two, was disturbed by its noise. While, however, I have a number of well-authenticated cases of such an instinctive repugnance to and something like dread of the sea, I find that there is by no means uniformity in children's behavior in this particular. A little boy who first saw the sea at the age of thirteen months, exhibited signs not of fear but of wondering delight, prettily stretching out his tiny hands toward it as if wanting to go to it. Another child, who also first saw the sea at the age of thirteen months, began to crawl toward the waves. And yet another boy at the age of twenty-one months, on first seeing the sea, spread his arms as if to embrace it.

These observations show that the strange big thing affects children very differently. C—— had a particular dislike to noises, which was, I think, early strengthened by finding out that his father had the same prejudice. Hence, perhaps, his hostile attitude toward the sea.

Probably, too, imaginative children, whose minds take in something of the bigness of the sea, will be more disposed to this variety of fear. A mother writes me that her elder child, an imaginative girl, has not, even now at the age of six, got over her fear of going into the sea; whereas her sister, fifteen months younger and not of an imaginative temperament, is perfectly fearless. She adds that it is the bigness of the sea which evidently impresses the imagination of the elder.

Imaginative children, too, are apt to give life and purpose to the big, moving, noisy thing. This is illustrated in M. Pierre Loti's graphic account of his first childish impressions of the sea, seen one evening in the twilight. "It was of a dark, almost black-green; it seemed restless, treacherous, ready to swallow; it was stirring and swaying everywhere at the same time, with the look of sinister wickedness." †

There seems enough in the vast waste of unresting waters to excite the imagination of a child to awe and terror. Hence it is needless to follow M. Loti in his speculations as to an inherited fear of the sea. He seems to base this supposition on the fact that at this first view he distinctly recognized the sea. But such recognition may have meant merely the objective realization of what had, no doubt, been before pretty fully described by his mother and aunt, and imaginatively pictured by himself.

The opposite attitude—that of the thoroughly unimaginative

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* *Op. cit.*, p. 131.

† Le Roman d'un Enfant.

child—in presence of the sea is well illustrated by the story of the little girl, aged two, who, on being first taken to see the watery wonder, exclaimed, "O mamma, look at the soapy water!" The awful mystery of all the stretch of ever-moving water was invisible to the child, being hidden behind the familiar detail of the "soapy" edge.

There is probably nothing in the natural world which makes on the childish imagination quite so awful an impression as the watery leviathan. Perhaps the fear which one of my correspondents tells me was excited in her when a child by the sudden appearance of a mountain may be akin to this dread of the sea.

We may now pass to another group of fear-excitants—the appearance of certain strange forms and movements of objects.

The close connection between æsthetic dislike and fear is seen in the well-marked recoil of a child of thirteen months at the sight of an ugly doll. The said doll is described as a black doll with woolly head, startled eyes, and red lips. Such an ogre of a doll might well call up a tremor in the bravest of children.

In another case, that of a little boy of two years and two months, the broken face of a doll proved to be highly disconcerting. The mother describes the effect as a mixture of fear, distress, and intellectual wonder. Nor did his anxiety depart when, some hours later, the doll, after sleeping in his mother's room, reappeared with a new face.

In such cases, it seems plain, it is the ugly transformation of something familiar and agreeable which excites the feeling of nervous apprehension. Making grimaces—that is, the spoiling of the typical familiar face—may disturb a child even at the early age of two months.* Such transformations are, moreover, not only ugly but bewildering, and where all is mysterious and uncanny the child is apt to fear.

Children, like animals, will sometimes show fear at the sight of what seem to us quite harmless objects. A shying horse is a puzzle to his rider, his terrors are so unpredictable. Similarly in the case of a timid child, almost anything unfamiliar and out of the way, whether in the color, the form, or the movement of an object, may provoke a measure of anxiety. Thus a little girl aged one year and ten months showed during a drive signs of fear at a row of gray ash trees placed along the road. This was just the kind of thing that a horse might be expected to shy at.

As with animals, so with children, any seemingly uncaused movement is apt to excite a feeling of alarm. Just as a dog will run away from a leaf whirled about by the wind, so chil-

* Quoted by Tracey, *op. cit.*, p. 29. But this observation seems to me to need confirmation.

dren are apt to be terrified by the strange and quite irregular behavior of a feather as it glides along the floor or lifts itself into the air.*

In these cases we may suppose that we have to do with a germ of superstitious fear which seems commonly to have its starting point in the appearance of something exceptional and uncanny that is unintelligible, and so smacking of the supernatural. The fear of feathers as uncanny objects plays, I am told, a considerable part in the superstitions of folklore. Such apparently self-caused movement, so suggestive of life, might easily give rise to a vague sense of a mysterious presence or power possessing the object, and so lead to a crude form of a belief in supernatural agents.

In other cases of unexpected and mysterious movement the fear is slightly different. A little boy, when a year and eleven months, was frightened when visiting a lady's house by a toy elephant which shook its head. The same child, writes his mother, "at one year and seven months was very much scared by a toy cow which mooed realistically when its head was moved. This cow was subsequently given to him at about two years and three months. He was then still afraid of it, but became reconciled soon after, first allowing others to make it moo if he was at a safe distance, and at last making it moo himself."

There may possibly have been a germ of the fear of animals here; but I suspect that it was mainly a fear of the signs of life (movement and sound) appearing when they are not expected and have an uncanny aspect. The close simulation of a living thing by what is known to be not alive is disturbing to the child as to the adult. He will make his toys alive by his own fancy, but resent their taking on the full semblance of reality. In this sense he is a born idealist and not a realist. More careful observations on this curious group of child-fears are to be desired.

Concerning an African idea of the origin of monkeys or chimpanzees, Mr. Herbert Ward relates a fable of the natives of Balangi and adjacent tribes of the upper Congo, to the effect that many generations ago a tribe of natives who lived on the banks of the Congo River, near Bolobo, fell into a condition of debt and difficulties with their neighbors. In order to escape the persecutions of their wrathful creditors, they retired into the great forest. Time passed, but they still remained poor. Forest life degenerated them. Hair grew upon their bodies. They arranged to forego speech, lest they should be recognized. They are still in the forest, and are known as *Bakewa*, or monkey men. Upon being asked if they ate chimpanzees, a member of the Balangi tribe replied: "No; we are not cannibals!"

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* See The Pedagogical Seminary, i, No. 2, p. 220.

ARCHÆOLOGY IN DENMARK.

By Prof. FREDERICK STARR.

A MUSEUM of national history is, in a sense, a symptom of patriotism. No wonder, then, that in Denmark, where every child absorbs love of country with his mother's milk and inhales it at every breath, such museums are in high favor. Two great governmental museums at Copenhagen illustrate the history proper of Denmark; one, the Museum of Northern Antiquities, is chiefly devoted to objects back of history.

Prehistoric archæology may almost be said to have taken its rise in the sturdy little northern kingdom. Here it was that Thomsen in 1836 first proposed the terms age of stone, age of bronze, age of iron, now universally used in the science. Thomsen was a man of profound learning, of most simple and beautiful character, and of immense energy. More than any other single man influential in the establishment of the museum, he shaped its early policy, and his name remains closely associated with its history. Director Thomsen believed in the educational value of the collections, and was ever ready to answer the question of a child or to explain to the common people the meaning and importance of the objects here displayed. This policy has been continued to the present, and the result is that the Museum of Northern Antiquities is known and loved by all good Danes (Fig. 1).

Fig. 1.—C. J. Thomsen.

The greatest name in Danish archæology is that of Worsaae. Of keen intellect, thoroughly scientific in his mode of thought, of remarkable executive ability, he gave final shape to the whole subject. Under his direction the museum grew enormously; most important explorations were conducted; steps were taken for the permanent preservation under governmental patronage of important tumuli, dolmens, and other antiquities and monuments both historic and prehistoric. J. J. A.

Worsaae was, moreover, a writer of force, and his archæological books and lesser writings are classical. The prehistoric chronology of Denmark suggested by him is practically that now used by all students; it is about as follows:

Stone age.	(*a*) Earlier	3000 to 2000 B. C.
	(*b*) Later	2000 to 1000 B. C.
Bronze age.	(*a*) Earlier	1000 to 500 B. C.
	(*b*) Later	500 to 100 B. C.
Iron age.	(*a*) Pre-Roman	100 B. C. to 100 A. D.
	(*b*) Later	100 A. D.

Thus fortunate in its early directors, the museum is no less fortunate in having for its present director a worthy follower of these two great men. Sophus Müller is ably carrying on the work of Thomsen and Worsaae. Assisted by a competent corps of helpers, the museum is vigorously prosecuting the work of field collecting, noting, mapping, and preservation of Denmark's antiquities. Dr. Müller has recently produced two important volumes entitled Ordning af Danmarks Oldsager. Volume I is devoted to the stone age, Volume II to the bronze age. The third volume, upon the iron age, is in preparation. In these works every type of Danish archæology is carefully described and the very great majority accurately figured. The text is Danish, but a *résumé* in French accompanies it; the pictures, of course, speak all languages (Fig. 3).

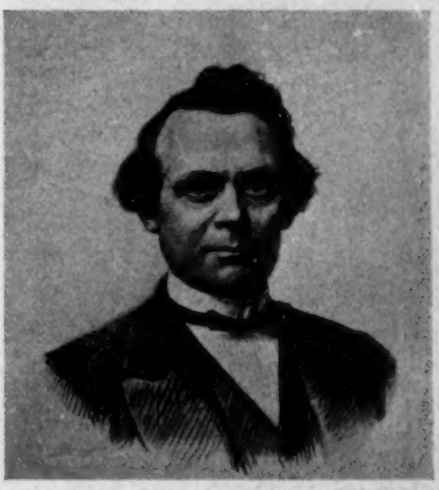

FIG. 2.—J. J. A. WORSAAE.

In Danish archæology there is *no palæolithic period.* Glacial deposits abound in Denmark, but so far evidence of man's existence there at that time is lacking. Very shortly after the ice retreated man must have appeared, and from that time on both the islands and Jutland have been occupied by busy, active, progressive men.

The oldest monuments seem to be the shell heaps or *kjoekkenmoeddinger.* These abound along certain parts on the coast, especially along the Kategat and elsewhere in Zealand and in Jutland. They are heaps sometimes hundreds of metres in length, dozens of metres in width, and as much as three metres in thickness. They consist mainly of the broken or entire shells of ma-

rine mollusks—the oyster, cockle, mussel, and periwinkle being the most common. Scattered through this mass of shells are bones of mammals, birds, and fishes, fragments of rude pottery, flint flakes, an occasional implement of bone, or a roughly chipped axe or knife of flint. Here and there are to be seen signs of fires. The word *kjoekkenmoedden* means a kitchen-refuse heap, and that is just what we have. These "kitchen middens" are old camp sites. Here men once lived. These shells and bones are refuse from their meals; these bits of pottery are parts of their dishes; these flint and bone tools were lost or discarded by the earliest Danes. Although living mainly upon mollusks, the man of the shell heaps was also a hunter. We have referred to bones of beasts and birds in the heaps. The eminent zoölogist Prof. Steenstrup, still living though now a very old man, carefully studied the "kitchen middens." He made an estimate of the frequency of bones in the heaps; each cubic foot contains ten to twelve bones of birds and mammals. It will easily be seen that the number of individuals represented in a large heap is really very great. The mammals found most frequently are the stag, reindeer, and wild boar. The relics from the shell heaps are of very rude workmanship. Flint flakes (Fig. 4) are common; a little chipping

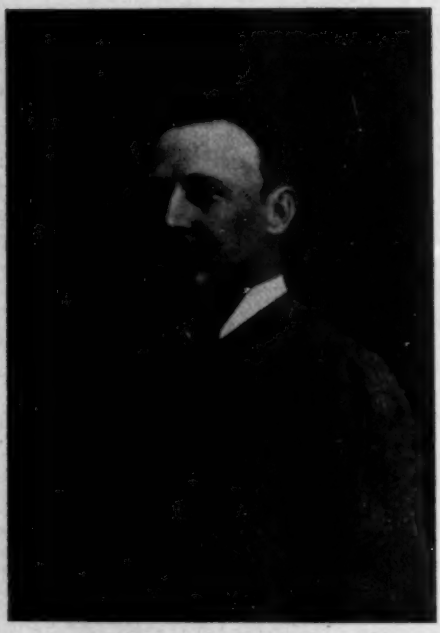

FIG. 3.—SOPHUS MÜLLER.

FIG. 4.—FLAKE. Flint.

makes one of these into an axe, a knife, a saw, or an adze (Figs. 5 and 6). Occasionally little broad-edged chipped flints are found (Fig. 7). The type is one found in other parts of Europe, and it has given rise to considerable discussion among archæologists. There can be little doubt, however, that they are really blunt-

point arrowheads; one Danish specimen has been found still attached to its slender shaft. The pottery fragments from the shell heaps are usually small, plain, and very rude and coarse. Bone piercers and combs are found occasionally. All the relics and the conditions of life hinted at by the food supply indicate that the primitive Danes were a low and savage people. Sir John Lubbock reproduces a picture of their life, no doubt very similar to that of the modern Fuegians. He says: "On the low shores of the Danish archipelago dwelt a race of small men, with heavy, overhanging brows, round heads, and faces probably much like those of the present Laplanders; living in tents of skin, they had weapons and implements of stone, bone, horn, and wood. Their food, consisting mainly of shellfish, comprised also fish and game. Probably eating was *gorging* and marrow was a delicacy. They were not summer visitors, but may likely enough have migrated frequently." (Not literal quotation.)

FIG. 5.—KNIFE OR SCRAPER. Flint.

Yet this savage or barbarous man was not entirely without brute helpers. Among the mammalian bones in the heaps are those of the dog. Of course, the question arises whether these are the remains of wild dogs hunted as food, or those of domesticated or semi-domesticated dogs living about the settlement. Steenstrup's attempts to answer the question are sufficiently well known. He observed that nearly all the long bones of animals and birds were reduced to shafts, the heads or extremities having disappeared; he observed also that short bones were rare or almost lacking—there being fully twenty or twenty-five long bones for every short one. Struck by these facts, he experimented with dogs, giving them bones to gnaw. He found that they devoured short bones and gnawed the heads off the long bones, leaving the shafts in precisely the condition of those from the shell heaps. He concluded that dogs, at least half tamed, lived around the village and gnawed the bones thrown upon the refuse heaps.

FIG. 6.—AXE. Flint.

The Danish shell heaps are old. Worsaae estimates that they date to 3000 to 2000 B. C.

It is certain that since they were heaped up important changes have taken place in Denmark—changes in geography, in fauna, in flora. The sea line has changed; these heaps were formed at the water's edge—to-day many of them are at a considerable distance from the sea. The Baltic has become so fresh that oysters, once abundant and very large, have abandoned its waters. The hollows in the glacial deposits, during the centuries that have elapsed since the ice sheet withdrew, have gradually filled with peat formed by the decay of successive generations of plant life. The peat tells its own story to the geologist and declares that Denmark was clad in coniferous forests after the Glacial period; later it was covered with oak growth; at present, and for centuries past, beech has been the main arboreal product. Ah, well! the "kitchen middens" go back to the time of the evergreen forests. Bones of the capercailzie or blackcock are found in the shell heaps; this bird dwells no longer in Denmark, and it lives only on the buds of certain conifers. When these old gatherers of shellfish and hunters of stags lived here the *Urus* still inhabited Jutland, and game of many kinds was abundant.

FIG. 7.—BLUNT ARROWHEAD. Flint.

FIG. 8.—UNPOLISHED CELT. Flint.

FIG. 9.—POLISHED CELT OR HATCHET. Flint.

A year since we visited a shell heap in West Jutland that was being excavated under the direction of Mr. Neergaard, assistant of the museum. Located at the edge and on the slope of a terrace, at some little distance from the sea, it extended for many metres along the terrace, presenting a width of several metres and a maximum thickness of 1·75 metre. It had been cut across by a

trench two metres wide and about eleven metres in length; this section was being removed carefully, a single cubic metre at a time. Every bone, potsherd, flint, or other relic as it was removed was

FIG. 10.—SAW. Flint.

FIG. 11.—AXE. Stone.

at once labeled, and a complete record regarding it entered in a note-book. The commoner shells at this locality were species of the genera *Ostrea*, *Cardium*, *Littorina*, *Nassa*, *Tapes*, and *Mytilus*. Bones of various birds, mammals, and fish were rather common. The day we were there two diggers removed about three cubic metres of material, and the yield of relics was four rude flint axes, one fishhook, and some bits of pottery. The upper level area of the terrace proper is sprinkled with flakes, knives, and hatchets of flint, plain evidence of an old village site.

The later neolithic of Denmark presents a magnificent development. Flint of the finest quality is found everywhere. In no part of the world did its chipping attain greater perfection. Material for other implements of stone was not rare, and was fully utilized. The consequence is that throughout the country beautiful relics of the later stone age are found; they lie on the surface; they are dug up in plowing and in excavations of all kinds; they are picked out by peat cutters; they are discovered in tumuli or old graves. Lubbock says: "Many of these barrows, indeed, contain in themselves a small collection of antiquities, and the whole country may even be considered as a museum on a great scale. The peat bogs, which occupy so large an area, may almost be said to swarm with antiquities, and Prof. Steenstrup estimates that, on an average, every column of peat three feet square contains some specimen of ancient workmanship."

FIG. 12.—DAGGER. Flint.

This part of the stone age was marked by the curious habit of erecting great monuments of stone and earth—dolmens, giant chambers, etc. Such monuments are sometimes called

megalithic monuments, from the great size of the stones used in their construction. Erection of megalithic monuments was by no means peculiar to Denmark, but was practiced throughout western Europe during the later stone age and on into the bronze age.

FIG. 13.—SPEAR POINT. Flint.

It is stated that there are upon the islands of Denmark and in eastern Jutland about 47·5 of these monuments to every square myriameter, or one to about two kilometres square. In a single afternoon's drive from Olstyke around by Roskilde Fiord to Roskilde, a distance of but a few miles, we examined fully a dozen of different types. Three of these will illustrate their character. (*a*) *Dolmen:* Near a long and narrow strip of water, on a little mound of earth; consisting of five great granite rocks; four stood upright on edge, set firmly in the ground, and inclosed a nearly rectangular space six feet or more in length, more than three feet wide, and some five feet high. Three of these stones are of equal height, and bear a great cap-stone; the fourth one is not so high, and serves as a sill or threshold to the chamber. The whole structure is now free and exposed, but it was probably originally covered with a mound of earth. (*b*) *Giant's Chamber:* Externally, a simple plain mound of earth about fifteen feet high. As it is one of the monuments preserved by the Government, it is supplied with a little door on one side. Passing through this, we found our way through a short passage into a great chamber at right angles to it; the passage enters this chamber at the middle of one of its long sides. Both chamber and passage are walled with great bowlders, and are roofed with slabs of large size. The chamber is about twenty-one feet long, seven feet wide, and over six feet in height. (*c*) Badly denuded by the weather; a large part of the covering mound is gone; there are no roofing slabs, but the stones are carefully set on edge so as to inclose a space forty feet in length and more than twenty feet in width; there is no sign of a passageway. In the middle of this inclosed space is an admirably made rectangular chamber about four feet deep, six feet in length, and perhaps four feet in width.

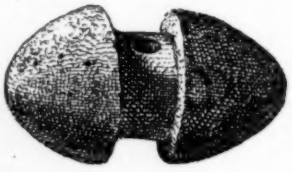

FIG. 14.—MINIATURE HAMMER. Amber.

It is probable that all these structures were burial places.

In those which have remained intact skeletons are often found, together with objects of use or decoration. The dolmen type is generally considered the older; the *jattestue*, or chambers with passage, are later; the rectangular stone coffins, or cists, with no approach are still more recent. The later stone-age man in Denmark cared well for his dead. He apparently believed in a future life, else why should he so carefully bury with his dead such beautiful and valuable objects? In some cases a tumulus might be erected for a single dead man; very commonly, however, several dead were buried in one mound; occasionally scores were thus companions in a common grave.

FIG. 15.—GARMENTS OF THE BRONZE AGE.

The man of the later stone age in Denmark was not ill equipped. Implements and tools and ornaments of stone, bone, horn, wood, etc., were his. His list of weapons and tools included beautiful celts or hatchets of flint finely polished, war clubs, lances, arrows, poniards of flint chipped to the most graceful forms, axes, chisels, saws, knives, scrapers, hammers (Figs. 8–13). This is but a part: wonderful samples of chipping, of polishing, of drilling; beautiful in form and finish. Nor were they useless objects. The weapons were perfectly adapted to their purpose. As for the tools, we may be sure that they were serviceable. In the little town of Broholm, in Fünen, is a small wooden house containing a fine collection of stone implements. These were found on the estate of a nobleman, who, after gathering the series, ordered carpenters to build for him a house for their display, stipulating that they should only use the old stone tools in its construction. A book has been written giving the full details of the work, and we can see that a carpenter of our day might be in a worse plight than to be supplied only with a neolithic kit of tools.

That neolithic man in Denmark was an artist is shown by these wonderful stone objects; it is also shown by the beautiful

forms and neat decorations of his pottery and by his ornaments. Of these last the most interesting certainly are those of amber. This brilliant yellow fossil resin early attracted his attention. At first he strung the rough pieces, just as he found them, on to strings or thongs, or rounded the bits into rude beads; later on amber was worked carefully into various pretty or curious forms. A favorite pendant was a miniature axe (of the same shape as the stone ones in actual use) in amber (Fig. 14). Curious questions are suggested by these. Neolithic man in Europe seems to have had superstitious ideas or even reverence toward the stone axe. It is possible that these miniatures in amber were amulets or charms.

This rich development of the stone age which we have been considering is generally referred to the period from 2000 to 1000 B. C. It is considered as an outgrowth from the ruder conditions

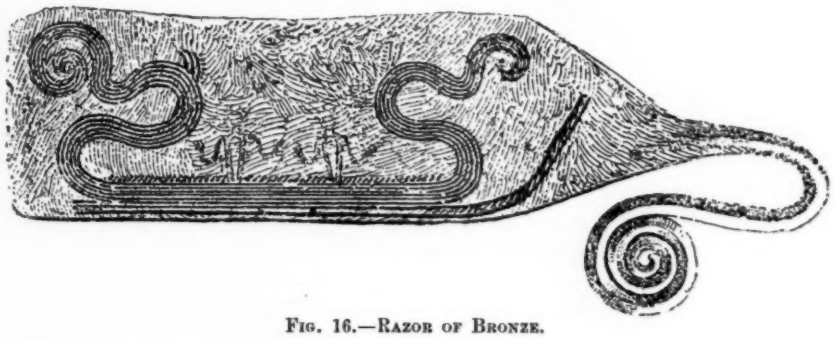

FIG. 16.—RAZOR OF BRONZE.

of the kitchen middens. It is but fair to state that a bitter controversy has been carried on over the matter. Some—among them Steenstrup—have argued that this high culture and the savagery of the shell heaps were contemporaneous; that the men of the *kjoekkenmoeddinger* and of the *megalithic monuments* were neighbors; that poor, primitive, backward fisher folk lived side by side with rich, advanced, more civilized agriculturists of the interior. We have not space to present the argument; we follow Worsaae.

The bronze age in Scandinavia was a marvelous development. Probably the knowledge of bronze was brought to Denmark from the Orient; perhaps the amber of the northwestern country was bartered to the cultured people of the East. However that may be, bronze reached Denmark. Nor were the skillful chippers and polishers of stone slow in learning how to use the new and precious material. Those who had been the best lapidaries of Europe became the best metallurgists. Nowhere are there so many peculiar, beautiful, and artistic types in bronze as in Denmark and Sweden. Bronze was made into implements and weapons; it

was also fashioned into ornaments. Gold, too, was known and widely used.

We have emphasized the fact that the dead were buried during the neolithic. At the beginning of the bronze age inhumation

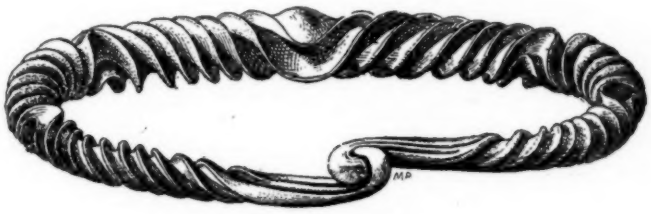

FIG. 17.—BAND OF BRONZE.

was also practiced. Stone cists of full size were constructed in many cases; in others very curious coffins, made by splitting oaken tree trunks and then hollowing the two pieces, one into a trough and the other into a cover, were constructed. As time passed cremation was practiced; the ashes were buried in stone cists, which gradually diminished in size until at last they were only about a foot square. In these latter cists the ashes were frequently placed in a vessel of clay. Finally, the cists disappeared, and the clay urn containing the ashes might be simply covered with a flat stone and buried in the ground. As cremation gained and the grave cists diminished in size, the gifts placed with the dead became fewer and less important; real objects were replaced by inferior ones or miniature make-believes. Had we only the relics from the graves we would be led to think that art degenerated during the bronze age; but the contrary was really true. The objects found in the peat bogs and elsewhere show an improvement and progress in artistic work.

FIG. 18.—GOLD CUP.

Certain grave mounds in Jutland have informed us as to the dress of the people of the bronze age. In them were found oaken coffins such as we have described above. In these, wrapped in cowskin shrouds, have been found the remains of men and women, more or less preserved, with garments and funereal objects almost intact. High woolen caps, with knotted cords all over the outside for ornamentation; wide mantles cut round; mantles of mixed wool and hair; waistbands bound around with a tasseled girdle;

sleeved jackets—all well made and of good material—are among the garments (Fig. 15).

To describe even a tithe of the types in bronze would require more space than we may use. Of weapons we may mention swords and daggers, beautiful in form and decoration, lance and spear heads, battle-axes; of tools and implements, hatchets, axes, knives, razors (so called) of quaint shape and frequently with engraved patterns on the blade (Fig. 16); of ornaments, every conceivable variety of rings for fingers, arms, neck, and head. The ornaments may be either of gold or bronze. Some of the neck or head bands are elaborately twisted (Fig. 17); finger and arm rings may be simple rings or may be spirals; fibulæ or safety pins are worked out in many curious and attractive patterns. Vessels, too, of gold or bronze have been found, and these, reproduced by modern workmen, delighted many visitors to the Exposition in 1893 (Fig. 18).

FIG. 19.—BRONZE BATTLE HORN.

Among the masterpieces of the bronze-worker which have come from that olden time to us are great bronze battle-horns, called by the Danes *lur*. These are truly gigantic. Twenty-three specimens have been found in Denmark, all in peat bogs, and most of them in pairs (Fig. 19). For years a dozen of these lurs hung in the museum silent. Recently Dr. A. Hammerich secured permission to study them as musical instruments and to test them. Finally, these were played upon

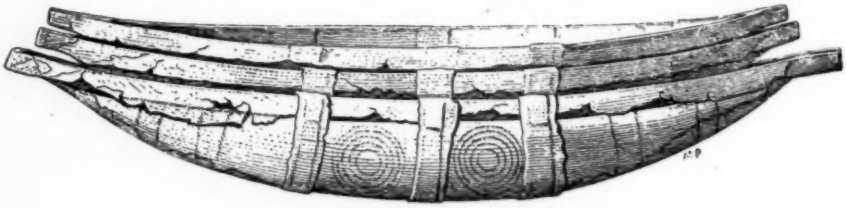

FIG. 20.—MINIATURE BOAT OF GOLD.

before a large and enthusiastic audience, the king himself being present. Only a few times since have these old horns been sounded, but on one of these occasions we had the good fortune to be present. Two players from the opera were the performers; the court of the museum was filled with hearers. Wonderful, is

it not, that horns two thousand years old, buried for long centuries in peat bogs, should, after this long silence, still be capable of giving out clear, ringing—even sweet—tones?

The conditions in which these lurs are found are most suggestive—always in peat bogs, usually in pairs. This could not be the result of accident. Other objects are found purposely laid away in the same manner: thus ten bronze hemispherical plates were found at one spot; nine fine bronze axes, all of one form, at another. Similar clusters of celts, spears, etc., are not uncommon. On one occasion about one hundred miniature boats of thin beaten gold were placed in a vessel and buried; such occurrences are not completely understood. Dr. Sophus Müller believes that such purposely buried or sunken objects are *ex votos* (Fig. 20).

FIG. 21.—A. P. MADSEN.

The early iron age presents interesting problems and wonderful relics. Still *prehistoric time* in Denmark, it is *historic time* in much of Europe. The Danes now disposed of their dead both by inhumation and cremation; with those who were buried relics are found. Near Tistrup, in West Jutland, with Captain A. P. Madsen, of the museum, we were present at some excavations. Captain Madsen has long been engaged in studying the archæology of Denmark. He is an artist of no mean ability, and has sketched and painted many of the old monuments. His *Bronzealderen* and other works (one of which is now appearing) are important and especially valuable for their illustrations. He is an indefatigable field explorer (Fig. 21). The spot was a level field overgrown with heather in bloom. Only the practiced eye would have detected aught there of archæological interest. The whole area, however, was covered with low, flat, round mounds several metres in diameter and less than half a metre in height. Digging revealed at the center of each, only a little below the surface, a single pottery vase. The forms were simple, but characteristic of the age. In them were mixed earth and ashes (the remains of a cremated corpse). Iron fibulæ, fragments of bronze rings, and the like were found with some of these.

In such cases the bronze is usually fairly preserved, while the iron is deeply rusted and frequently quite fragile.

The best preserved iron objects come from certain peat mosses. In some of these enormous deposits have been found. The famous localities are *Nydam* and *Thorsbjerg*, now, unfortunately, no longer Danish possessions. At Thorsbjerg the articles were found mainly in a layer of soft dark peat, about five feet thick, which was under eleven feet of peat of a different character. The objects were apparently placed here intentionally and at one time. Several layers of wooden shields, one above the other, with javelins

FIG. 22.—COMMEMORATIVE BRONZE TABLET IN MUSEUM COURT.

thrust through them; in another spot, pieces of chain mail; elsewhere, bundles of iron spearheads or arrowheads wrapped in chain mail, a cluster of objects of gold, vessels of clay sunk by stones placed in them. Everything had been destroyed or rendered worthless before it was placed here. Of course at that time the upper eleven feet of peat had not formed, and there was probably a pond of water above the antiquities-bearing layer. At Thorsbjerg, for some reason, the iron has not been well preserved; at Nydam it is in excellent condition. Here the relics lay at a depth of some four to seven feet on a sandy and clayey bottom; as at Thorsbjerg, the objects are clustered and grouped together as if

sunken in bundles; here, too, the objects have been rendered useless before deposition. Spears and swords were thrust violently, perpendicularly through the stratum containing the relics. At this locality, too, were found two or three boats; the largest, of oak, some seventy-seven feet long and about ten feet wide, was a fine piece of work. These were intentionally sunk. Some of the iron objects were magnificent pieces; certain sword blades were handsomely damascened. Roman workmanship or influence is shown by some of the objects from these mosses. A number of Roman coins from here range from about 60 to 217 A. D. Thus we may fix the age of the deposit.

We have but glanced at a few of many interesting matters which are fully illustrated in this great museum, of which Denmark is so justly proud (Fig. 22).

THE OFFICE OF LUXURY.

By M. PAUL LEROY BEAULIEU.

THE question whether luxury is legitimate or illegitimate, useful or injurious, is most actively debated. The moralists claim that it is within their peculiar field, and it has been one of their favorite subjects for discussion from the days of antiquity down. We can not, however, leave it to them. Economists have an interest in it. It does not concern only precepts and rules for an edifying conduct of life, but bears also upon the direction that ought to be given to production, or to a considerable part of it at least, and upon the influence of certain kinds of consumption on the distribution of wealth and on the respective situations of different classes of society.

One of the difficulties encountered in the discussion, and no small one at that, is that of finding an exact definition of luxury. Most even of the best definitions are insufficient and vague. It is very hard to find an absolute formula for a thing so relative, fluctuating, and variable. The definition we would propose is that luxury consists of that superfluity of enjoyment which exceeds what the generality of the inhabitants of a country at a given time consider essential, not only for the necessities of existence but also for decency and comfort in life. It is, therefore, curiously variable, constantly taking a new position as the limit of ordinary enjoyment advances at a corresponding pace with the increasing wealth and refinement of a society. This definition has the merit of regarding luxury as relative and as changing in standard from age to age.

To the barbarians who ravaged the Roman Empire the simple

furniture and wardrobe of a modest household of our middle class of people, or of the better class among our working people, would have seemed to have a profusion of luxurious objects; a few not costly easy-chairs, a carpet, window curtains, cheap wall paper, a looking-glass, a clock, a few vases filled with flowers, a small show of plate, shirts, handkerchiefs, neckties, stockings—all would be new to them, and not essential either for the normal wants of existence or even for decency and pleasant living. The idea of what constitutes luxury varies in the most striking manner according to the country, the times, and the classes of society. Each class considers a luxury whatever its circumstances do not allow it to possess, and which a higher class is, nevertheless, able to enjoy. It has been manifest over and over again that the luxury of one period, or of one social class, tends inevitably to become at least a requisite of respectability for the following age and the next lower class. Civilization is characterized by the gradual, progressive, general distribution of many elements of luxury which thus gradually lose that character. Every ten years, some luxuries cease to be such in consequence of their becoming more common and cheaper.

In speaking of the principle of luxury we should consider it apart from the excesses and excrescences that have been associated with it. A great many men regard luxury as an abuse, a sin, a scandal. Some imagine that if it were got rid of, society would be happier and more moral. Many believe that the superfluities of some are gained at the expense of necessaries of others. The enemies to the principle of luxury may be arranged in two divisions: moralists and politists, and economists.

The political arguments against luxury bear chiefly upon the two points that it increases the separation between the classes of the population, and makes it more marked; and that it enervates man and makes civilized populations more easily subjects for spoliation by barbarians. We have shown in another place that the gap between the conditions of different classes of men is tending to diminish.* This inequality, furthermore, has not unwholesome effects only; it is both the result and the stimulus of civilization. In regard to the dangers that luxury may bring upon the state, it should be observed that luxury is one thing and luxurious living is another. We may love and seek luxury in furniture, decoration, and objects of art, and live simply. The physical deterioration assumed to result from luxurious tastes has not been proved. In almost every country of Europe the young people of the most aristocratic classes display,

* Essai sur la répartition des richesses et la tendance d'une moindre inégalité des conditions.

in physical exercises and acts of courage, at least as much vigor and resolution as men of other social grades. Civilized peoples have during the past three centuries obtained most brilliant advantages over barbarians. If civilization is threatened, it is much less by the taste for elegance in living than by the poison of certain doctrines, and by a mental and moral dilettanteism that has no necessary relation, in its adepts, to an enlightened taste for objects of luxury.

When we read most of the criticisms that have been uttered against luxury, even by great writers, we find that they are inspired by a thought as inexact as it is superficial; by the mistake of supposing that the superfluous luxuries enjoyed by the wealthy are acquired at the expense of the necessaries of the poor. If no fine shoes were made, it is said, everybody would have good shoes; but all men in civilized countries have got their good shoes without the manufacture of fine boots for men and women being diminished. Again, we hear, would the world not be better off if, instead of ten or twenty thousand objects of luxury, ten or twenty thousand useful things were made?

The question can not be put in this way. The conception of social activity that lies at the bottom of this reasoning is false. It regards social activity as a factor fixed once and forever; and it imagines that if we take five hundred thousand days' work for superfluities, this five hundred thousand days' work will be lacking for necessaries. We should ask whether man's productive capacity, his inventive force, his energy in working, and the progress of the arts and sciences have not been kept up and extended by the constant seeking for a more embellished life and the satisfaction of more diversified wants; if a society that does not condemn and proscribe luxury has not, even in the matter of common objects, an infinitely greater productive force than a society that does condemn and proscribe it. We should inquire if the taste for novelty and change that characterizes luxury does not contribute to keep the general spirit of a society more on the alert, more ready to institute better industrial conditions and make discoveries and improvements; and if, on the other hand, a society always held down to the same kind of monotonous, insipid life would be as productive, even in agriculture and the common arts, as another, excited to incessant activity by luxurious tastes.

Industrial progress and the extension of general wealth make common many articles once regarded as luxuries. Sugar, spices, and coffee were once luxuries; drinking glasses, window panes and curtains, and carpets. Watches and clocks were grand luxuries till they could be made for eight or ten dollars. In articles of clothing, shirts, stockings, shoes, pocket-handkerchiefs (even in Montaigne's time), ribbons, and lace were regarded as super-

fluities which men and women living naturally could well do without. In London, in the eighteenth century, the use of umbrellas was looked upon as effeminate. In the planning of the household, a dining room distinct from the kitchen, a parlor distinct from the dining room, a sitting room distinct from the bedroom, a bath room and water-closet, were considered useless, and are still by some people. Thus, fortunately, the bounds of luxury keep on retreating. The luxury of other days becomes, if not a necessity, an enjoyment of the present, useful or inoffensive, within the reach of a large number of men. Whether its roots lie in sensuality and vanity, as its critics affirm, or in æsthetic taste, luxury, if it is not in violation of Nature, is propagated through the instrumentality of man's imitatve instinct; of his desire to conform to the ways of those in the highest ranks, and to the feelings and manners prevalent in the community. Thus luxuries are gradually transformed into decencies. Old men seldom fail to call every new fashion, and everything of the uses of which they were ignorant in childhood or mature age, a luxury.

The character of a thing in use should be judged, not according to certain ideas we form of human nature in general, but according to circumstances of time, place, climate, profession, and surroundings.

The evolution of luxury has been divided into three periods: the luxury of primitive periods, which was exemplified in patriarchal times, and in the beginning of the middle ages; luxury of flourishing and prosperous peoples, as in the modern age; and the luxury of peoples in decay, like the ancient Romans and the Orientals.

Primitive luxury is very simple. It consists chiefly in the grouping around the rich man, who is also usually of high birth, of a large number of servants supported by him, and in the practice of an extensive hospitality. The furnishings of this luxury are very limited: fine wardrobes, elegant arms, spirited horses, and rich caparisons. Though pleasant in appearance, and having a family air, this patriarchal luxury has its inconveniences, which are much less apparent in modern luxury. It creates and maintains legions of parasites and idlers. Its world of servants and clients do little work, but are supported by the labor of others. It brings no refinement in living, it is burdensome, nurses conceit, diminishes production, and deprives numbers of people of their independence, exposing them to the vices of indolence. Another phase of this primitive luxury was exhibited in the great feasts, which were characterized by quantity rather than quality, with coarse revels lasting many days. This luxury was occasional rather than permanent, and did not penetrate, as the later living did, into the whole tissue of life. The

people's equivalent for the expensive feastings and revels of the grandees was found in kirmesses and carnivals. The forced sobriety of these uncultivated ages was interrupted by periodical debauches. No thought was taken of comforts. Except for the furnishings of the church and drinking vessels, there were few things of beautiful finish. Fashions did not change; there was no elegance and no variety in daily personal life, and workmen's wages were very small. Thus all was for display and nothing for comfort, and waste of men and means was the rule. Very different is the luxury of civilized, intelligent, and thoughtful people, which looks more to the comfortable or to elegance and artistic enjoyment than to magnificence and sumptuousness. It includes and penetrates the whole life, and extends in different degrees over all classes of the people. It is distinguished by the use of an infinitely greater variety of goods, and for each kind of an increasingly more considerable range of qualities. It adapts itself to democratic habits, which it has contributed to introduce. Instead of encumbering himself with a great number of domestics, clients, and parasites the prosperous citizen has around him only the number of people he requires for a good and prompt service; while, on the other hand, he has at his command independent outside workmen who develop into the honored class of artisans. Together with the immense permanent household installations, external distinctions and extensive private establishments of all kinds are given up, their places being supplied by those which may be used in common with the public.

The luxury of these prosperous and democratic periods reaches in multiplied and infinite gradations all classes of the people; then, supplying itself with durable objects and permanent arrangements, it becomes an accompaniment of the whole life. Its great characteristic is variety and elegance in necessary and usual objects. The extension of this luxury into all grades of the population is aided by such technical knowledge as permits the substitution of less costly goods for those which are more so, whereby things formerly enjoyed only by the wealthy are put within reach of persons of modest means: thus plate and white metal take the place of silver; electrotypes, of carved work; lithographs and photographs, of engravings and paintings; and figured papers, of tapestries. Cotton and silk mixed or silk waste give the illusion of silk; tulle and gauze, of lace. New substances, like nickel and aluminum, make it easy to possess watches, clocks, and the like, elegant in appearance and yet cheap. Improvements in the mechanic arts aid in this; and everything is imitated, even pearls and diamonds. There is nothing immoral in this sort of luxury, which varies, brightens,

and embellishes life, and incites the man to better care of his house and his person. It is, rather, a motive of good economical and domestic habits. And it promotes a kind of saving. A man who will not lay up for old age will save money to buy a gold watch or a chain, or nice furniture. Fondness for variety is one of the characteristic traits of the luxury of intelligent and prosperous peoples. Variety in food, clothing, furnishings, and in amusements is an excellent stimulant to industry, a preventive of enervation of man's mind. It is likewise one of the most vital needs of human nature, one of the legitimate charms of life. The luxury of industrious and prosperous peoples is predominantly exhibited in the dwelling and the furniture. It creates permanent establishments that make life more pleasant. It transforms the house from a simple shelter into a commodious and pleasant mansion, beautified and vivified with numerous and interesting objects. Herein lies the inappreciable benefit of national modern luxury. This it is that has divided up the house according to the various wants and conveniencies for which it is intended to provide. The result is a more becoming, more private, and more independent daily life for each of the members of the family, as well as a more hygienic *régime*. The example spreads from the upper to all the social classes. The house becomes the center of man's efforts to embellish. Many bad habits and many vices are abandoned. It is a general opinion that whenever the workman shall have a sufficiently ample abode, diversified and adorned, the family life will retain more attractions and the saloon will lose them.

While modern taste expends liberally on the construction, furnishing, and decoration of the house, it encourages sobriety in the wardrobe. It is one of its characteristics that it makes itself compatible with civil equality and with fraternity in social relations, colliding with them in nothing. The dress of the men bears witness to this. Men are no longer to be seen, as Henry IV of France used to say, "wearing their mills and their forest estates on their backs." Lace, in sleeves and frills, formerly habitual with middle-class people, has long been left off by the men, and there is no prospect of its returning. Who, when he looks at an assembly of two or three hundred men, including representatives of all classes, from the highest to the most modest, can tell from their dress which are the wealthy ones? It is true that women still indulge in these little extravagances; but this does not prove that the majority of the rich expend more now upon dress than those similarly situated have done during the past three or four hundred years. We complain that maids wish to be dressed like their mistresses, farm-servants like the farmers' wives, and these like the landlords' wives. A few may

be extravagant; but nearly all these people, servants and farmers, save; and a little luxury in their lives does no great harm. By virtue of the blending of these shades of luxury between one social stratum and another, the difference in the lives of men of the several classes is much less as to the real enjoyments they are all able to procure than as to the cost of what they possess.

External luxury is becoming less conspicuous. There are no more gilded carriages with footmen and outriders, except to mark the state of ambassadors. The simple carriages now in use, however elegant their forms may be and handsome the horses that draw them, are otherwise as democratic in appearance, without showy harness decorations or extraneous ornaments, as the old-fashioned post chaises.

Judicious investment in luxury constitutes a kind of revenue fund for emergencies and times of need. This is true for all classes and for the whole nation. Jewels, pretty pieces, tapestries, pictures, and choice collections may be sold in periods of misfortune without loss. Even among those in more moderate circumstances the watch, the chain, the clock, and the cheap jewels are adequate to procure in days of distress or illness, if not much, something that could not be had otherwise.

Such luxury as this, far from being immoral and deleterious, is legitimate, commendable, and useful, provided that with it allowance is made from the income for future emergencies, and for saving.

Quite different is it with the luxury of periods of decay and of corrupt classes; for morbid social groups may exist even in a country generally sound. This luxury becomes immoral and unintelligent when, instead of responding to natural and normal physical and intellectual wants, it consists solely in the seeking for costly pleasures and objects simply because they are costly, in systematic waste, and in the single satisfaction of an extravagant vanity. These features of social life were marked among the wealthy classes of the Roman Empire, but appear only in individual examples and a few narrow circles in modern life. It is not by such eccentricities, which have become rare among modern peoples, that luxury is to be judged. As we have described it, it is impossible to condemn it. Regarded in a general aspect, and apart from its abuses, luxury is one of the principal agents of human progress. Mankind has it to thank for nearly everything which to-day adorns and embellishes life, and for a large proportion of what makes life more pleasant and wholesome. It is the father of the arts. Neither painting nor sculpture nor music, nor their popular accompaniments, could ever have become so greatly developed and so widely diffused in a society that had declared war on luxury.

It has been objected that if luxury did not exist the world would be better provided with articles of use. The millions that are spent in luxury, these objectors say, could be better applied to the production of wheat or of potatoes or of common clothing; if some were not too rich, none would be poor. This reasoning is at fault in two points: First, a million's worth of luxuries does not, as some persons think, represent the amount of labor and human force required to produce a million's worth of wheat or potatoes or common clothing or plain furniture. The cost of luxuries bears only a comparatively small relation to the quantity of good work; by far the greater proportion of it is paid for quality. An accomplished jeweler or engraver can earn three or four times as much in working at the art in which he excels as in applying the same quantity of labor to a coarser trade—blacksmithing, for instance. And if luxuries were abolished, and the artists now employed in producing them were set to some common labor in farming or the ruder trades, they would not be able to produce at them more than one third of the value which they now bestow upon the world of taste and refinement. In the second place, we need not deny that materially, and aside from a fact to be noticed, if mankind would limit its wants to bread and meat, to the commonest clothing, the most modest abodes, and the simple articles of use, it would be able to get a considerably larger number of such things. If all the painters, engravers, upholsterers, pleasure-coach makers, jewelers, makers of fine furniture, lace-makers, embroiderers, etc., should return to tilling the soil, spinning, weaving, and knitting, a more ample stock of the products of the common callings might be obtained. This is only possible. It is not certain. In assuming it we leave out of view the indirect consequences of such a profound modification in men's desires, in their life, in their motives to effort as such a change would work. We overlook the depressing, stupefying influence which monotony and uniformity in occupation would exercise upon man's activity, his spirit of initiative, and his zeal in research and invention. A society in which all were engaged upon nearly the same tasks, living in identical conditions, having narrow wants, none of them enjoying visions of a brilliant future different from that of his fellows, would fall dead with inertia and routine. It would lose in elasticity and inevitably becomes stationary, and finally retrograde; and it would not be paradoxical to assert that the suppression of luxury would result, in the course of time, in a diminution even of objects of ordinary consumption.

The stimulating action of luxury is incontestable, and operates upon every grade of the social scale. While luxury is not the only instigator of human activity, or even the principal one

it is one of unquestionable importance; and there are none too many instigating forces to arouse man from inertia and idleness. At the highest degree of the scale, some men—we will not say all—impose additional work and mental tension upon themselves in order to have an elegant house, fine gardens, and high style; in the middle of the scale, other men will put themselves to additional trouble in order to procure some comfort which was only recently a luxury, and can still hardly be distinguished from one, or in order to reach a certain standard of respectability in their manner of living, to which decorations and superfluities will contribute. At the bottom of the scale numerous men and women work longer or tax their ingenuity in order to procure for themselves some secondary elegances which have become common but are nevertheless luxuries, in that the abundance of them does not contribute to the satisfaction of man's rudimentary wants.

The influence of luxury is very great upon social progress and the arts, and upon the course of literary and scientific advance. Industrial advancement is usually brought about by the efforts of individuals of remarkable will and intelligence, but sensitive to the attractions of material rewards. The surest of such rewards for the numerous spirits not solely devoted to an ideal is wealth, and this to many men would lose its value if they were deprived of the luxuries which they could obtain with it. While there are many men of noble aspirations among great inventors and the projectors of important enterprises who would be satisfied with the good they accomplished, there are others, energetic, capable, and ardent, and valuable in economic progress, who are guided by less noble ideas, and who, in themselves or their surroundings, have keener perceptions of the attractions of luxury than of pure intellectual enjoyments and the satisfaction of an elevated self-respect. It is important for mankind as a whole that such men do all they can for it.—*Translated for The Popular Science Monthly from the Revue des Deux Mondes.*

THE Congo natives of all tribes, Mr. Herbert Ward says, are ready speakers, flowery in expression, adepts in the use of metaphors, clear in reasoning, and alert in debate. The sonorous effect of their speech is greatly aided by the soft inflections and harmonious euphony of their language. In many of the tribes it is common for the speaker to hold in his hand a number of small sticks, each representing a preconsidered point of his argument. Each point is subsequently enumerated and emphasized by selecting and placing one of these sticks upon the ground. A speaker will often begin his address by referring to events that happened in his earliest recollection, and in this manner will refer to every favorable incident in his career, whether his stories apply or not to the subject under discussion.

PROFESSIONAL INSTITUTIONS.

I.—PROFESSIONS IN GENERAL.*

By HERBERT SPENCER.

WHAT character professional institutions have in common, by which they are as a group distinguished from the other groups of institutions contained in a society, it is not very easy to say. But we shall be helped to frame an approximately true conception by contemplating in their ultimate natures the functions of the respective groups.

The lives of a society and of its members are in one way or other subserved by all of them: maintenance of the life of a society, which is an insentient organism, being a proper proximate end only as a means to the ultimate end—maintenance of the lives of its members, which are sentient organisms. The primary function, considered either in order of time or in order of importance, is defense of the tribal or national life—preservation of the society from destruction by enemies. For the better achievement of this end there presently comes some regulation of life. Restraints on individual action are needful for the efficient carrying on of war, which implies subordination to a leader or chief; and when successful leadership ends in permanent chieftainship, it brings, in course of further development, such regulation of life within the society as conduces to efficiency for war purposes. Better defense against enemies, thus furthered, is followed by defense of citizens against one another; and the rules of conduct, originally imposed by the successful chief, come, after his decease, to be re-enforced by the injunctions ascribed to his ghost. So that, with the control of the living king and his agents, there is gradually joined the control of the dead king and his agents. Simultaneously with the rise of agencies for the defense of life and the regulation of life, there grow up agencies for the sustentation of life. Though at first food, clothing, and shelter are obtained by each for himself, yet exchange, beginning with barter of commodities, gradually initiates a set of appliances which greatly facilitate the bodily maintenance of all. But now the defense of life, the regulation of life, and the sustentation of life, having been achieved, what further general function is there? There is the augmentation of life; and this function it is

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* The series of articles to which this is introductory will in their eventual form be chapters constituting Part VII of The Principles of Sociology—Professional Institutions. Hence the explanation of the various references and allusions to preceding parts of that work which they will be found to contain. The various references to books will, as in past cases, be found at the end of the volume when published.

which the professions in general subserve. It is obvious that the medical man who removes pains, sets broken bones, cures diseases, and wards off premature death, increases the amount of life. Musical composers and performers, as well as professors of music and dancing, are agents who exalt the emotions and so increase life. The poet, epic, lyric or dramatic, along with the actor, severally in their respective ways yield pleasurable feelings and so increase life. The historian and the man of letters, to some extent by the guidance they furnish, but to a larger extent by the interest which their facts and fictions create, raise men's mental states and so increase life. Though we can not say of the lawyer that he does the like in a direct way, yet by aiding the citizen to resist aggressions he furthers his sustentation and thereby increases life. The multitudinous processes and appliances which the man of science makes possible, as well as the innumerable intellectual interests he arouses and the general illumination he yields, increase life. The teacher, alike by information given and by discipline enforced, enables his pupils more effectually to carry on this or that occupation and obtain better subsistence than they would else do, at the same time that he opens the doors to various special gratifications: in both ways increasing life. Once more, those who carry on the plastic arts—the painter, the sculptor, the architect—excite by their products pleasurable perceptions and emotions of the æsthetic class, and thus increase life.

In what way do the professions arise? From what pre-existing social tissue are they differentiated—to put the question in evolutionary language? Recognizing the general truth, variously illustrated in the preceding parts of this work [The Principles of Sociology], that all social structures result from specializations of a relatively homogeneous mass, our first inquiry must be —in which part of such mass do professional institutions originate.*

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* When, more than twenty years ago, the first part of the Descriptive Sociology was issued, there appeared in a leading weekly journal, specially distinguished as the organ of university culture, a review of it, which, sympathetically written though it was, contained the following remark: "We are at a loss to understand why the column headed 'Professional,' and representing the progress of the secular learned professions . . . appears in the tables as a subdivision of 'Ecclesiastical.'"

The raising of this question shows how superficial is the historical culture ordinarily provided. In all probability the writer of the review knew all about the births, deaths, and marriages of our kings; had read the accounts of various peoples given by Herodotus; could have passed an examination in Thucydides; and besides acquaintance with Gibbon, probably had considerable knowledge of the wars carried on, and dynastic mutations suffered, by most European nations. Yet of a general law in the evolution of societies he was evidently ignorant—conspicuous though it is. For when attention is given, not to the gossip of history, but to the facts which are from time to time incidentally disclosed respecting the changes of social organizations; and when such changes exhibited in one society are

Stated in a definite form the reply is that traces of the professional agencies, or some of them, arise in the primitive politico-ecclesiastical agency; and that as fast as this becomes divided into the political and the ecclesiastical, the ecclesiastical more especially carries with it the germs of the professional, and eventually develops them. Remembering that in the earliest social groups there is temporary chieftainship in time of war, and that where war is frequent the chieftainship becomes permanent—remembering that efficient co-operation in war requires subordination to him, and that when his chieftainship becomes established such subordination, though mainly limited to war times, shows itself at other times and favors social co-operation—remembering that when, under his leadership, his tribe subjugates other tribes, he begins to be propitiated by them, while he is more and more admired and obeyed by his own tribe—remembering that in virtue of the universal ghost-theory the power he is supposed to exercise after death is even greater than the power he displayed during life; we understand how it happens that ministrations to him after death, like in kind to those received by him during life, are maintained and often increased. Among primitive peoples, life in the other world is conceived as identical in nature with life in this world. Hence, as the living chief was supplied with food and drink, oblations are taken to his burial-place and libations poured out. As animals were killed for him while he lived, animals are sacrificed on his grave when he is dead. If he has been a great king with a large retinue, the frequent slaughter of many beasts to maintain his court is paralleled by the hecatombs of cattle and sheep slain for the support of his ghost and the ghosts of his attendants. If he was a cannibal, human victims are furnished to him when dead as when alive; and their blood is poured on the grave-heap, or on the altar which represents the grave-heap. Having had servants in this world he is supposed to need servants in the other, and frequently they are killed at his funeral or sent after him. When the women of his harem are not immolated at his burial-place, as they sometimes are, it is usual to reserve virgins for him in his temple. Visits of homage made to his residence become, in after times, pilgrimages made to his tomb or temple; and presents at the throne reappear as presents at the shrine. Prostrations, genuflections and other obeisances are made in his presence, along with various uncoverings; and worship in his temple has the like accompaniments. Laudations are uttered before him while

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compared with those exhibited in other societies; the truth that the various professional agencies are derived from the ecclesiastical agency, is one which "leaps to the eyes," as the French say.

he is alive, and the like or greater laudations when he is dead. Dancing, at first a spontaneous expression of joy in his presence, becomes a ceremonial observance, and continues to be a ceremonial observance on occasions of worshiping his ghost. And of course it is the same with the accompanying music: instrumental or vocal, it is performed both before the natural ruler and the supernatural ruler.

Obviously, then, if any of these actions and agencies, common to political loyalty and divine worship, have characters akin to certain professional actions and agencies, these last must be considered as having double roots in the politico-ecclesiastical agency. It is also obvious that if, along with increasing differentiation of these twin agencies, the ecclesiastical develops more imposingly and widely, partly because the supposed superhuman being to which it ministers continually increases in ascribed power, and partly because worship of him, instead of being limited to one place, spreads to many places, these professional actions and agencies will develop more especially in connection with it.

Sundry of these actions and agencies included in both political and religious ministrations are of the kind indicated. While among propitiations of the visible king and the invisible deified king, some of course will have for their end the sustentation of life, others are certain to be for the increase of life by its exaltation: yielding to the propitiated being emotional gratifications by praises, by songs, and by various aids to æsthetic pleasures. And naturally the agencies of which laudatory orations, hymnal poetry, dramatized triumphs, as well as sculptured and painted representations in dedicated buildings, are products, will develop in connection chiefly with those who permanently minister to the apotheosized rulers—the priests.

A further reason why the professions thus implied, and others not included among them, such as those of the lawyer and the teacher, have an ecclesiastical origin, is that the priest-class comes of necessity to be distinguished above other classes by knowledge and intellectual capacity. His cunning, skill, and acquaintance with the natures of things, give the primitive priest or medicine-man influence over his fellows; and these traits continue to be distinctive of him when, in later stages, his priestly character becomes distinct. His power as priest is augmented by those feats and products which exceed the ability of the people to achieve or understand; and he is therefore under a constant stimulus to acquire the superior culture and the mental powers needed for those activities which we class as professional.

Once more there is the often-recognized fact, that the priest-

class, supplied by other classes with the means of living, becomes, by implication, a leisured class. Not called upon to work for subsistence, its members are able to devote time and energy to that intellectual labor and discipline which are required for professional occupations as distinguished from other occupations.

Carrying with us these general conceptions of the nature of professional institutions and of their origin, we are now prepared for recognizing the significance of those groups of facts which the historical development of the professions presents to us.

KIDD ON "SOCIAL EVOLUTION."

By W. D. LE SUEUR.

TO want to say something and to have something to say are two very different things. Mr. Benjamin Kidd, when he took in hand to write a book on Social Evolution, wanted very badly to say something; but whether he really had anything to say is a question upon which we can hardly imagine his own mind, now that he has had time to think over it, is fully made up. Yet when the book first appeared many persons thought that it was freighted with some important message. There was something so impressive and oracular in the manner of the writer, such an evident conviction on his own part that, like the poet invoked by Clough, he had to come to reveal to "trembling thinkers on the brink (who) shiver and know not how to think" just what was and is the matter with them, that the reader had to be more than usually forearmed against illusion not to find himself taking Mr. Kidd very seriously indeed, and reading into his pages all the high significance that was meant to be there but was not. The book, we are free to confess, is not an everyday one. It has a certain baffling quality which bespeaks a peculiar order of mind in its author. It is interesting to read: the style is good; the language is strong; the thoughts seem to have some substance; the author gives one the impression that he is working steadily forward to some important, or what ought to be an important, conclusion; and yet, when we come to ask ourselves what the main purpose of the book is, and what proposition of any importance it has established, it is uncommonly difficult to pass from interrogation to affirmation. It gives one the impression of a system with a shifting center of gravity. The author at once champions science and disparages it, exalts religion and denies it any footing in common sense; makes progress depend upon the unchecked action of natural selection, and again declares that its most important factor is the "ultra-rational" sanction which religion supplies for

right action; condemns socialism as unscientific and totally incompatible with the continued progress of civilization, and again presents as his ideal of the social state, and as the form to which it is surely tending, something which it is difficult to distinguish from socialism; commiserates mankind for being involved in a perpetual struggle for existence, and yet looks forward joyfully to a condition of struggle which he says will be more "intense" than anything the past has witnessed. It is possible that Mr. Kidd sees some way in his own mind of bringing these apparently contradictory views into harmony; but the general impression left on a careful reader of his book will be that his literary art includes the supreme accomplishment, to speak metaphorically, of riding two horses at the same moment in opposite directions.

Unfortunately, all readers are not careful, and some are prejudiced. These are days in which the glib *littérateur* talks about "the bankruptcy of science"; and Mr. Kidd, though he does not use the phrase, has done not a little to give countenance to the silly idea. Science, he tells us, has made such a distressing bungle in its treatment of religion, shown such hopeless incompetency, such amazing blindness, in connection with the whole subject! Alas! why did not Mr. Kidd appear a little earlier upon the scene, in order to prevent this painful scandal? He is a man of science—at least, he discourses with the air of one—and it is too bad that "science" should have incurred all this discredit when help was so near at hand. One might be disposed to ask whether science has not redeemed its character through the discoveries of Mr. Kidd, were it not that the latter is evidently indisposed to let his work go to the credit of science. Achilles has come out of his tent and mingled in the fray; but he does not want his mighty deeds to swell the glory of the Grecian name; rather would he flout the Greeks for the sorry figure they cut before he intervened. But, if Mr. Kidd's achievements are not to be passed to the credit of science, to what account are they to be credited? "Alone I did it" is a proud boast, but still we may ask, in what character? What is science if it is not organized and correlated knowledge? If Mr. Kidd has really helped to organize and correlate our knowledge on the subject of religion he has done a good thing; but Science must really claim that by so doing he has extended *her* boundaries and added to her conquests. And so the historian of nineteenth-century thought will say, if, when the complete work of the century comes to be narrated and appraised, "Kidd on Social Evolution" shall have managed to escape Libitina.

Let us, however, examine with a little attention Mr. Kidd's alleged discoveries, and let us see how far, if at all, science has been at fault in the matter.

It is charged that science "has no answer" to the question, What is the meaning, what is the function of religion in social development? It is asserted that "contemporary literature may be searched almost in vain for evidence of any true realization of the fact" that religious beliefs "must have some immense utilitarian function to perform" in the evolution of society. What are we to say to this? Simply that Mr. Kidd is not well informed on the subject of which he writes. We shall not be accused of diverging very far from the highroad of science, of betaking ourselves to any very obscure or devious paths, if we venture to quote on this point Dr. Henry Maudsley, author of a number of well-known works on mental physiology. Let us, then, turn to his work on Body and Will, republished in this country eleven years ago, and see what we can find bearing on this very question. On page 208 we read: "It is most necessary to bear in mind that forms and ceremonies, stereotyped propositions, articles of faith, and dogmas of theology do not constitute the essence of religion, but its vesture, and that, apart from all such forms and modes of interpretation, it responds to an eternal need of human sentiment. For it is inspired by the moral sentiments of humanity and rests on the deep foundations of sacrifice of self, devotion to the kind, the heroism of duty, pity for the poor and suffering, and faith in the triumph of good. It appeals to and is the outcome of the heart, not of the understanding; and so goes down into lower depths than the fathom line of the understanding can sound; for the intellect is aristocratic and the heart democratic, knowledge puffing up, but love uniting and building up, and the true social problem is to democratize the intellect through the heart. It is the deep fusing feeling of human solidarity, in whatsoever doctrines and ceremonies it may be organized for the time, that is religion in its truest sense; for it is in the social organism what the heart is in the bodily organism, and, when it ceases to beat in conscience, death and corruption ensue." Dr. Maudsley did not sound a trumpet before him that all the world might suspend its ordinary business in order to admire his originality, because he knew enough to know that, while what he was saying was well worth saying, it was not so very original after all. But after reading the above-quoted sentences from so well known a writer, what are we to think of Mr. Kidd's statement that "contemporary literature may be searched almost in vain" for any true recognition of the "utilitarian function of religion in the evolution of society"? And what great degree of originality can we attribute to the definition of religion which, after an elaborate preamble, Mr. Kidd delivers to us: "A religion is a form of belief providing an ultra-rational sanction for that large class of conduct in the individual where his interests and the interests of

the social organism are antagonistic, and by which the former are rendered subordinate to the latter in the general interests of the evolution which the race is undergoing." Whatever is true in this definition is expressed in simpler and stronger phraseology by Dr. Maudsley. Whatever meaning there is in the word "ultra-rational" is better expressed, it seems to us, in Dr. Maudsley's declaration that "it (religion) appeals to and is the outcome of the heart, not the understanding, and so goes down into lower depths than the fathom line of the understanding can sound"; while, as regards the furnishing of a sanction for actions performed in the interests of society, the language of Maudsley, who says that religion rests on "the deep foundation of sacrifice of self, devotion to the kind, the heroism of duty," surely covers the whole ground. On the next page to that in which these expressions occur we find the following: "Any one who looks forward with a light heart to the overthrow of Christianity might do well to consider what can ever adequately replace it merely as a social and humanizing force." We turn another page and read: "In him (the founder of Christianity) was the birth of the greatest social force that has ever arisen to modify human evolution"; and the paragraph ends with the declaration that if humanity is to progress, "it will, as heretofore, draw from a source within itself, deeper than knowledge, the inspiration to direct and urge it on the path of its destiny."

Now, we venture to say that Mr. Kidd has nowhere in his book put the case for the social utility of religion more strongly than it has been put in these passages and many others which we might quote from one of the most advanced of modern scientific thinkers. But Dr. Maudsley, as we have already hinted, does not, in what he says on this subject, take up any very peculiar position. Mr. Spencer fully recognizes religion as an indispensable source of moral control in early stages of society, and as one that can ill be discarded even in our own day. He believes that it will be progressively purified of all doctrines that are not essential to it, and that it will abide as an ineradicable consciousness of a power behind phenomena, in and by which all things exist. Schopenhauer declared that the metaphysical impulse of the human race, that by which it seeks to formulate those transcendent truths that are of the substance of religious belief, is no less fundamental in human nature than the scientific impulse; and the later Schopenhauerians, like Prof. Paul Deussen, whose excellent little book on Metaphysics has lately been given to the world in an English dress, use language which might be supposed to have been specially intended to forestall what Mr. Kidd evidently regards as his most striking and original utterances. Take the following passages, for example, from Prof. Deussen: "For

opposed to the natural and egoistic actions, affirming the will to life, are certain actions which show a diametrically opposed striving. The only explanation of these actions is that the actor always sacrifices in them, to a certain extent, his own individual and limited existence by expanding his ego beyond the bounds of his individuality, recognizing his own self in others." "In investigating the action of man, which is, in general, an expression of the affirmation of the will to life, we meet a series of actions which are, in the natural order of things, inconceivable, being diametrically opposed to this world and its laws, contradicting these in every sense, and, as it were, totally unhinging them. These phenomena are the deeds of a genuine morality." "Thus the totality of human action appears as the expression of two opposed currents—one, *egoistic, affirming, mundane;* the other, *ascetic, denying* (i. e., self-denying), *supramundane.*" "We may denote faith as that which has as its inevitable result morality." It is impossible for any one who has read these passages and many similar ones to be much startled when he is informed by Mr. Kidd that "throughout its existence (viz., of the social organism) there is maintained within it a conflict of two opposing forces: the disintegrating principle represented by the rational self-assertiveness of the individual units; the integrating principle represented by a religious belief, providing a sanction for social conduct, which is always necessarily ultra-rational."

The fact is that the conception of religion as an influence constraining men to identify their own good with that of the community apart from all calculations of selfish interest is one very generally entertained in the present day, and not less, certainly, by men of science than by others. It lies at the basis of Feuerbach's remarkable book on The Essence of Christianity. It is clearly expressed in one or two of the late Prof. Clifford's essays; it can be traced in the writings of the late Prof. Tyndall and of Prof. Huxley; probably it would be difficult to discover an intellectual region of any note in which it is not more or less distinctly accepted.

But, says Mr. Kidd, "Science from an early stage in her career has been engaged in a personal quarrel" with successive religious systems. The quarrel "has developed into a bitter feud." Yet, instead of investigating this historic antagonism in a scientific spirit, and asking "whether it was not connected with some deep-seated law of social development," Science "seems to have taken up, and to have maintained, down to the present time, the extraordinary position that her only concern with them is to declare that they are without any foundation in reason." Now this seems to us, to speak plainly, not only an incorrect but a very nonsensical statement. Science has only antagonized religion in

so far as demonstrable scientific errors have been put forward as essential parts of this or that religious system. And it was not science, be it remembered, that insisted that such errors were essential to the integrity of religion; it was religion, as represented by its official expounders, that took up this position. It was not Galileo who said that religion could not exist if the Ptolemaic system of astronomy were overthrown; it was the Church. All Galileo asked was leave to establish a purely scientific theory. It was not the founders of modern geology who insisted that religion must stand or fall with belief in a six-days creation; it was their opponents, the uncompromising partisans of a traditional theology. It was not Darwin or Spencer who said that religion could not withstand the shock of the evolution theory —the latter said expressly that it could and would—it was again the party that spoke in the name of religion. If a certain number of scientific men were carried away by the vehement assertions of the champions of religion into believing and speaking as if religion itself were about to be involved in the ruin of the erroneous views which had formed part of its popular presentment, can we wonder at it? And if to-day the impression is widespread that religion has been shaken and discredited by the advance of science, on whom must the blame chiefly rest? Without doubt on those who, not distinguishing between the accidents of religion and its essence, fought a losing battle with science on matters that were wholly within the jurisdiction of the latter.

Science, Mr. Kidd says, has lost sight of the main question, which is not whether religious beliefs have "any foundation in reason," but whether they "have a function to perform in the evolution of society." This again is incorrect; science has not lost sight of this question, but on the contrary has of late years devoted a large amount of attention to it. Never was it so clearly recognized as it is to-day that beliefs may have no foundation in reason, and yet have a more or less important "function to perform in the evolution of society." The proofs of this are so abundant that it seems a waste of time to produce them. But for very specific statements take the following from Vignoli's work on Myth and Science, published in the International Scientific Series: "Man rises in the social scale by means of his superstitious and religious feelings, which act as a stimulus and symbol, so far as he subjects his animal and perverse instincts to the precepts which he imagines to be expressed by these myths" (page 106). And again (page 321), "The problem of myth is transformed into the problem of civilization." Turning to a very recent work, Mr. Havelock Ellis's The New Spirit, we find the author asking, "What is the nature of the impulse that underlies, and manifests itself in, that sun worship, Nature worship, fetich wor-

ship, ghost worship to which . . . we may succeed in reducing religious phenomena?" Here is the very question which Mr. Kidd says modern science does not face. What is Mr. Ellis's answer?—"The supreme expression of the religious consciousness lies always in an intuition of union with the world, under whatever abstract or concrete names the infinite not-self may be hidden. . . . It comes in the guise of a purification of egoism, a complete renunciation of the limits of individuality—of all the desires and aims that seem to converge in the single personality—and a joyous acceptance of what has generally seemed an immense external Will now first dimly or clearly realized. . . . It is this intuition which is the 'emptiness' of Lao-tsze, the freedom from all aims that center in self." When one has been reading things of this kind from day to day for years, it is a little provocative of fatigue to find Mr. Kidd attaching so much importance to formulas of his own devising that are essentially of the same significance.

But possibly Mr. Kidd, it may be suggested, states the function of religious beliefs much more definitely than has ever been done before, and throws new and vivid light upon their origin and *rationale*. We can not see that there is the least foundation for such a claim. We are told by this author that religion is essentially an "ultra-rational sanction" for actions which, though injurious to the individual, are beneficial to the community. Is any light whatever thrown on the nature of religion by calling it an "ultra-rational sanction"? The term "ultra-rational" is essentially negative. We understand from it that religion is a sanction with which reason has nothing to do. What we want to know is, What *has* to do with it? Whence is its authority derived? How far are rational beings bound or compelled to recognize and bow to it? Is it something like the law of gravitation that no one can resist, or is it a mere habit of mind that can be outgrown, perverted, or destroyed? If all that Mr. Kidd has to tell us of the nature of religion is that it is *a* sanction, and that reason has nothing to do with it, or rather that it is contrary to reason, we certainly have not much to thank him for. Far more are our thanks due to Hegel and Feuerbach and Comte, to Spencer and Martineau and Arnold, to Müller and Reville and Caird, who all, from their several points of view, have endeavored to explain what religion is and to define its place in the sum of human powers and faculties. The time is not far distant, Mr. Kidd says, when Science will "look back with shamefacedness to the attitude in which she has addressed herself to one of the highest problems in history"; but we fail to see either what Science has to be shamefaced about, or what Mr. Kidd has himself done to mark out better lines for the action of Science in the future.

Science finds, we are told, mankind holding beliefs which she asserts have no foundation in reason; and Science has not done the right thing in the premises. What on earth, then, should Science have done? Should Science have refrained from criticising the errors in regard to plain matters of fact which she found incorporated with popular religious creeds? So far as we can judge, Mr. Kidd himself seems to have benefited from such criticisms. In regard to the doctrine of evolution, he is a stalwart of the stalwarts. His faith, anticipating proof, has even taken hold of the extreme theory of Weismann and pressed it into the service of his sociological speculations. But the doctrine of evolution is precisely the one to which the religious world found it most difficult to reconcile itself, and one which, indeed, it is impossible to hold without at least a tacit criticism of views formerly considered as essential to religious faith. Did Mr. Kidd win his present position for himself without antagonizing the religious instincts and convictions of the mass of his fellow-men? If he did, it must have been because other men prepared the way for him; for certainly, not without much tribulation, has Science established its claim to judge freely and according to evidence of things within its ken. The world, we are informed, no longer takes the interest it once would have done in such attacks as Prof. Huxley has lately been making on certain orthodox beliefs. Well, if so, we must regard it as a good sign; for it can only mean that the world—that is to say, the thinking world—looks upon Prof. Huxley's labors as a little superfluous. Still, it is well to remember that even to-day the energetic professor's attack on the miracle of the Gadarene swine has been warmly repelled by eminent ecclesiastical authorities.

It would really be interesting to know Mr. Kidd's precise views as to the etiquette to be observed by "science" in its relations with religious systems which take under their patronage and vouch for gross scientific or historical errors. If science does not criticise such things, who or what is going to do it? If no one does it, what chance is there that religion will ever shake itself free from such accretions? Will the several priesthoods of the world see to it that the faiths they represent are progressively purified from error? In the last two centuries of the Roman Republic and the first two of the Empire, the question how to treat foreign cults, which were seeking a foothold in Rome itself, was a serious one for the state. Mr. Kidd was not present to caution the Roman Senate against rash action, or to point out that the great question was not whether these cults did or did not involve material errors, but what bearing religious systems in general had on the development of society; consequently the Senate had simply to follow its own best lights. "These Bacchic rites," says

a recent writer, "of undoubtedly Oriental origin, and for centuries common enough in Greece and Asia Minor, were apparently introduced into Etruria by a Greek adventurer, and from there spread with extreme rapidity both in Italy and Rome. At first women only were admitted into the secret associations which formed the basis of the cult; the initiation took place by day, and the meetings were only held three times a year. But all this was now changed; men were initiated as well as women; the initiated were to be under twenty years of age. Meetings were held five times in every month, and took place under the secrecy of night. The inevitable enormities did not fail to follow, and the Bacchic associations became hotbeds not only of moral corruption, but of civil crimes such as forgery and murder and even of political conspiracy."* Attention having been called to these abuses, the Senate acted vigorously, and the Bacchic rites were stamped out with great severity (B. C. 188). A century later, the same writer tells us, the Roman Government was confronted with the Isis cult, but was not able to deal with it in the same energetic fashion, owing to the fact that the national religion had largely lost its hold upon the people. "Mysterious rites of initiation," we read, "sensuous music, a worship crowded with symbolism no less awe-inspiring that it was imperfectly or not at all understood; and above all, a system of expiatory and purificatory rites in which there was enough of asceticism to satisfy the craving for something personal in religion, and enough of license to attract the crowd in its non-religious moods, all these things made the population of Rome peculiarly susceptible to the influence of cults like the Egyptian."†

What bearing have these historical instances, it may be asked, on the subject in hand? A tolerably direct bearing, we think, as tending to show that if there is anything that needs to be watched and criticised, anything the claims of which to prescribe conduct or to limit knowledge need to be challenged and examined, it is precisely religion in its varying forms and phases. Religion, to go back to Mr. Kidd's definition, provides an ultra-rational sanction for socially useful actions; but when, let us ask, has religion been content with enjoining the performance of such actions on the strength of its ultra-rational sanction? It is true that an apostle has beautifully said, "Pure religion and undefiled before God and the Father is this, to visit the fatherless and widows in their affliction, and to keep himself unspotted from the world"; but this is merely the utterance of a profound individual intuition, not the expression of what, historically, religion has ever been.

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* E. G. Hardy, Christianity and the Roman Government, p. 10.

† Hardy, as above, p. 13.

How vehemently the most earnest exponents of religion have repudiated the idea that it could be identified with morality, in however comprehensive a form, need not be insisted on.

To do justice to science it is not necessary to represent it as the unfailing minister of truth, or to assign to it any absolute character whatever. The less we deal in personifications and abstractions the better, when historical or social problems are demanding solution. To understand the function of science in the world we have simply to remind ourselves that man possesses a faculty of comparison and judgment by which he is compelled to recognize, unless overmastered by his imagination, likeness or unlikeness, equality or inequality, agreement or disagreement, in the things which occupy his attention. The exercise of this faculty leads to classification, which, in the higher form of generalization, is the source and vital principle of all knowledge. The more knowledge man acquires, the more certainly he can interpret and correlate the data of sense. Among his impressions and inferences there is a continual struggle as to which shall survive; and those which, by their deeper conformity to unchanging facts, assert their viability, go to form the tissue of what we call science. To talk, therefore, of what "science" does or does not do is very apt to be misleading. Science is like a coral reef, built up of innumerable accretions, the result of the life processes of organic bodies. We may from one point of view define science as the enduring products of man's intellectual activity. That the history of science should be largely a record of errors and failures follows of necessity from the fact that the work of science consists essentially in the attacking of ever-new problems with more or less inadequate means of investigation. But the very failures of science are necessary to its successes; and it never turns aside from its main function and purpose of harmonizing, consolidating, and extending human knowledge. Its permanent relation to religion can thus easily be understood. Religion, appealing to imagination and resting more or less upon myth, incorporates in its creed statements or assumptions which fall within the domain of science, and which, if inacurate, the latter is obliged to challenge; but there is no necessary hostility between the scientific impulse to know that which can be known and the religious impulse to worship a Power that can not be known, and to frame higher sanctions for life than those of the market place and the law courts. Religion, which is essentially emotional, is slow to recognize the rights of science; and science, in the conflicts which ensue, is in danger of overlooking the fact that religion is something more than a misinterpretation of the world and of history.

The signs of the times all give us reason to hope, however, that a better *modus vivendi* than the past has ever known is

about to be arrived at. Religion is more and more withdrawing from the disputed territory of facts historical and physical, and saying in effect to Science: "I am no longer your rival on this ground; so now tell us freely all you know about the world and its origin, about man and his descent; tell us whence we sprang, how we have come to be as we are, with such thoughts and instincts, such hopes and fears, such aspirations and superstitions as you wot of; and what the future is to which we may look forward. Tell us if you can the *raison d'être* of this universe. Henceforth I shall not dispute with you one single verifiable fact; so now deliver to the world a free, untrammeled message; tell us all the truth you know." Thus challenged, Science becomes solemn under a new sense of responsibility, and its thoughtful reply might be: "I see but in part, I know but in part. I pass through my hands the successive links of a chain, but the beginning of the chain and the end are not only beyond my vision but beyond the flight of my strongest thought. I organize knowledge, I minister to the physical and intellectual wants of men; whatever a finite faculty of judgment is capable of, I may hope to accomplish; but if man has a craving to know his relation to the universe, I can not determine it; if he wants a higher motive than expediency (in the widest sense) for his actions, I can not supply it; if he craves to believe in an Infinite Goodness, I can not demonstrate it for him; if he longs for a life beyond the present, I can not assure him that such a longing will be realized. Here, then, is *your* province, with which I engage not to interfere; and if, while I increase man's power over the energies of physical Nature, you can raise him to a nobler self-control and a higher sense of moral dignity; if you can satisfy his emotional longings and place his whole life on something more than an empirical foundation, then shall I reverence your work and recognize that I am but your humbler yoke-fellow in the service of the race."

We have reached the limits of our space, and find that we have only dealt with one point of the book under review. In our opinion, however, it is the most important point, as being the one that was most calculated to lead the general reader astray. We should have wished to devote two or three pages to what we consider the very faulty account Mr. Kidd gives of the function of the intellect in connection with social progress; but that, if it is to be done at all, must be done some other day.

THE only industry in the hamlet of Nova Varos, Sandjack of Novi Bazar, is the manufacture of carpets and rugs. Every girl, on marriage, takes one or more rugs and a large painted chest to her husband. For this reason each house makes its own rugs, and each house uses what it makes.

AN OLD NATURALIST—CONRAD GESNER (1516–1565).

By W. K. BROOKS,
PROFESSOR OF ZOÖLOGY IN THE JOHNS HOPKINS UNIVERSITY.

Illustrated by Photo-engravings reduced from the Original Woodcuts.

SO many lives have been devoted to the earnest study of Nature that disinterested zeal and untiring industry are no peculiar claims to our interest, however inspiring and instructive they may be.

CONRAD GESNER was not only a faithful student and a great educational influence, but a hero who took life in his hand for the service of man, and calmly facing horrors more awful than a battlefield, laid it down, like so many forgotten physicians, at his post of duty.

His great work on natural history, which was published in Zurich (1551–1587), is one of the chief sources of that interest in

FIG. 1.

the living world which has grown stronger and stronger from his time to the present day.

There were other men who merit the title of naturalist in Gesner's day. We find the spirit of original research in Rondolet, and in Belon, whose intense love of Nature led him on in his wanderings from his home in France, over the mountains and valleys of Greece and along the shores of the Archipelago, through Asia Minor far into Egypt.

Aldrovandi also made formal calls on Nature, visits of state to her haunts, taking notes on her ways, for he says: "I often wandered through the vineyards and fields, over the marshes and mountains, accompanied by my draughtsman, carrying his pencil, to draw whatever I pointed out; and by my amanuenses, with

their note-books, to write down at my dictation whatever occurred to me."

It is the great distinction of Gesner that, without sacrificing the dignity of science, he made it attractive, and thus became a great educational influence. His contemporary and friend, Dürer, has been called the "evangelist of art," and the title of "evangelist of science" might with equal propriety be applied to him, for

FIG. 2.

he is one of the foremost representatives of that time of intense and contagious industry "when art was still religion."

The modern world takes morbid interest in the crudity and errors of early writers on science, and we are in no danger of forgetting their views on griffins and krakens, on goose barnacles and spontaneous generation. Their merits are less interesting and seem too antiquated and too far below our mark to be notable simply as good, faithful work.

The demands of current scientific literature leave us no time for the ponderous volumes of ancient writers, but if we had time to spare we should find in many of them both pleasure and profit, although it is quite true that their value as sources of scientific knowledge has passed away, and that later writers have helped themselves to all that is best in them, and have passed it on to us.

One of Gesner's greatest services to natural science is the introduction of good illustrations, which he gives his reader by hundreds.

Work under his severe scrutiny was a valuable training to the draughtsman and engraver of his day, and the publication of his

natural history, filled with simple but spirited pictures of animals, did much to educate the critical powers of the public.

We can not appreciate the educational value of his work without tracing it into other fields, and studying its influence on contemporary art.

Before the day of photography success in drawing living animals depended to a great degree upon the study of earlier attempts, upon the imitation of their successes, and the correction of their failures and shortcomings; and the success of Gesner's draughtsmen, who had few models to copy, was very notable. Their attempts to draw strange and unfamiliar animals are not always happy, but most of the drawings of familiar forms are full of life and spirit, even after they have been interpreted by the wood engraver, who unquestionably failed to render them with perfect accuracy.

Little is known about the makers of the drawings. Gesner says he made some of the originals himself, and also employed several draughtsmen, who lived in his house and gave him all their service. He also says most of the cuts were drawn from life under his supervision, and that he gives the original source of all that are copied or supplied by friends or correspondents.

Like most authors of illustrated works on natural history, he found his own standard of accuracy hard to reach, and he says:

FIG. 3.

"I admit that all the illustrations are not well drawn, but this is not the place for explanations. Most of them are pretty fair, or at least tolerable, especially those of the quadrupeds, which may be considered the best."

The woodcuts made from these drawings are remarkable examples of the skill of the old wood engravers, and they have high claims on the interest of students of the history of their art.

All attention is concentrated on the central figure, and few of the cuts have any accessories whatever; but they are not dia-

grams, and the engraver boldly faces all the difficulties of texture and markings, and uses his best resources to overcome them. His success is notable, as the photographic reprints show, and work under Gesner must have contributed not a little to the advancement of wood engraving. The cuts which are here reproduced are selected to exhibit the wide field which Gesner covers, and to show at the same time something of the resources of his engravers, and, while good drawings have been chosen, no attempt to pick out the best has been made. All the reproductions are considerably reduced, and they give a false impression of delicacy, although they faithfully exhibit the accuracy and versatility of the old engraver.

FIG. 4.

The names of very few of the draughtsmen or engravers are known, but Gesner says that Lucas Schrön drew the birds, and that Albrecht Dürer made the cut of the rhinoceros.

This statement has led many writers on wood engraving to reproduce this cut, which has thus become familiar to us, although it is by no means a fair sample of Gesner's illustrations.

The typography of Gesner's book and the binding of many of the copies are as notable as the cuts. In fact, all the craftsmen met the author in generous rivalry and mutual inspiration, and it would be difficult to produce a nobler monument than that which their combined labors created.

While Gesner has recorded many original observations, the work as a whole is a compilation undertaken for the express purpose of gathering in one book a summary of all trustworthy observations on living things. The work was done so thoroughly that it records for all time the status of natural science in his day, and forms a permanent landmark in its history.

Its educational influence upon his contemporaries was due to the attractive and simple way in which he presents the subject, but its scientific value to-day is due to the exhaustive completeness with which he compiled it.

He read nearly two hundred and fifty authors and his literary learning is almost unparalleled. The list of authorities quoted

or referred to and of the correspondents who supplied notes, illustrations, and oral information includes nearly every ancient and mediæval writer who makes any reference to animals. He draws from many works which are now known only through his references, and his long list of friends and helpers includes Italians, Frenchmen, Englishmen, Germans, Swiss, and Poles.

He tells us that while it is easy to assert that history should be written from the best books only, he has found no book too bad to yield something to judicious study, and that he has ignored nothing.

"Only those who have tried," he says, "can know what a labor it is to compare the works of different authors and to bring all into unity, with nothing overlooked and nothing repeated. This I have tried to do so faithfully that all may be brought together, a library in itself, so that no one need hereafter consult other writers on the ground which I have covered. As my only purpose," he tells us, "is to make the work more useful and accurate, I have exercised the more incredulity and have critically revised the quotations, and, when possible, verified them by original observations and dissections."

FIG. 5.

The completeness of the work is astonishing when we bear in mind that he was only thirty-five when the first part appeared, and that he had already published thirty-four works, among them two which are as remarkable as the Natural History for learning and industry, and that all the illustrations for the Natural History were prepared and the whole book written with his own hand and printed in eight years.

The dignity and thoroughness of his work are in strong contrast to many of the discursive and trivial works of his time, and his compilation was made with good judgment and independence. When he now and then quotes descriptions of fabulous or imagi-

nary animals or repeats fanciful tales, he seldom fails to record his own opinion of their value, unless they are contained in letters from correspondents, who are always treated with courtesy.

Modern writers have disputed Gesner's title to a position among men of science on two grounds. It is held by some that since science is the reference of the phenomena of the universe to the fundamental properties of matter, none of the old naturalists who did not have this aim have any scientific standing; but as this point of view shuts out men like Wallace, Gesner is expelled in good company.

Others hold that Gesner's weakness is his lack of the conception of systematic zoölogy, and his failure to so arrange his facts as to exhibit natural affinity and do away with endless repetition.

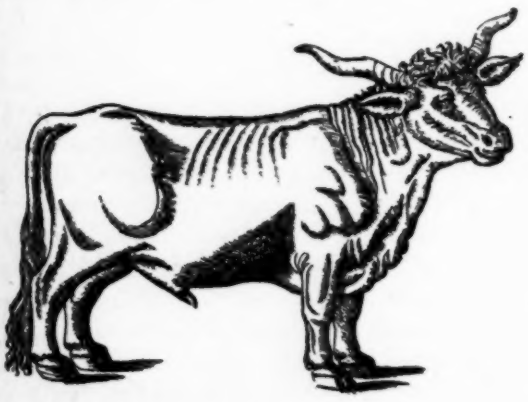

FIG. 6.

As a matter of fact, he does recognize natural relationship, and often treats allied animals together; thus, for example, under Bos we find not only Taurus, Vacca, and Vitulus, but also Bison, Bonasus, and Urus.

He says, in the introduction to the book on water animals, that he has followed the alphabetical order, rather than a more philosophical system, for the sake of easy reference, and on account of his uncertainty regarding the affinities of many of them.

This criticism was to be expected from the systematists of the last generation, but the modern morphologist can not cast it in Gesner's face, for, while he feels sure that there is a natural or genealogical classification of animals, he admits, like Gesner, his "uncertainty about the affinities of many of them."

We are told (Encyclopædia Britannica, article Gesner) that "his life was singularly pure and blameless; his love of knowledge was as disinterested as it was engrossing. He was always ready and glad to acknowledge any help he received. When obliged to engage in controversy, he did so in a dignified and courteous manner. His medical writings show him to have been far above the silly prejudices of his day. A cheerful and amiable piety was a prominent feature in his character—a character chastened, not soured, by the trials of a hard lifetime."

Gesner's short life was a struggle with poverty and ill health, but he did not suffer neglect, for there is evidence that his contemporaries held him in honor and took a just pride in his industry and simple earnestness.

The magistrates of Zurich appointed him chief physician and Professor of Philosophy and Natural History in 1553, and the magistrates of Lucerne welcomed him, in 1554, with those distinguished honors which were usually reserved for high public officers.

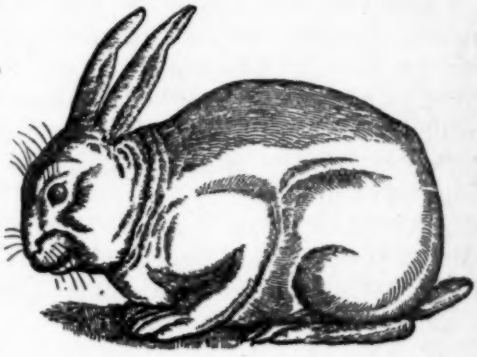

FIG. 7.

The Emperor Ferdinand granted armorial bearings to him and his family, with a statement of his desire to express his appreciation of his work, and to encourage others to follow his example.

His death was the glorious climax of his earnest, laborious life. When the plague broke out in Zurich in 1564 he devoted his scientific skill and professional experience to the effort to discover some way to check it; he threw himself into this inquiry with such earnestness that he himself contracted the disease, and, after a short illness, died in his museum, to which he had been carried a short time before, at his request.

FIG. 8.

He was interred in the cloisters of the great church of Zurich the next day with most distinguished honors, and a large concourse of people of all ranks followed him to the tomb, amid the mourning of the whole city.

I have selected as an illustration of Gesner's method of treating his subjects the chapter on the marmot; for here, as in many other places, we find proof of the injustice of the assertion that he was not an original observer, but simply a compiler.

THE MARMOT (*Mus Alpinus*).

ITS SHAPE AND OUTLINE AND WHERE TO FIND IT.—In shape, outline, and size this animal is like a big rabbit, but lower and with a broader back. Its hair is coarser than that of a rabbit, of a reddish color, darker in some places and lighter in others. It has big eyes, placed above the cheek-pouches. In its mouth are long, yellow teeth, much like those of a beaver, two above and two below. The length of its tail is two hands or more. It has short, thick, hairy feet, like those of a bear, with long, black nails, which enable it to dig deeply into the earth. While the rest of the body is lean, the back is fat, although this fat is not real fat, but something between fat and meat, like the substance of the udder of the cow. This animal is found only on the very highest tops of the Alps. The widely known Dr. Conrad Gesner has himself traveled in these regions and observed its habits.

ITS NATURE AND PROPERTIES.—While playing and frolicking together the marmots make a noise not unlike that of a cat, but when they are angry or wish to warn each other of a change in the weather, their cry is sharp and penetrating, and very disagreeable to the ear of man, like the noise of a highly pitched small flute. On account of their offensive voice they are often called manure-barkers.

FIG. 9.

This animal sometimes walks on its two hind legs. It uses its fore paws like hands, grasping its food with them, like a squirrel, and eating while it sits on its hind legs. It eats not only fruit, but many other things, such as bread, cheese, meat, fish, and nuts, especially when accustomed to them in captivity. It prefers milk and cheese above all other food, and it is often caught by the peasants in the milk cellars, where it is easily discovered by the noise it makes in drinking the milk, like a young pig.

It is a drowsy animal, sleeping often and long. It makes its

nest with two openings—one, pointing up the mountain, is used for walking in and out, while the other, which points down the mountain, is not used for these purposes, but as a place for depositing urine and fæces. A short passage leads from the burrow which connects these openings to a room or nest which is lined with hay, straw, or similar light substances.

About Michaelmas, when the mountains begin to be covered with snow, they hide themselves in their house, first plugging the openings with earth so firmly that they are harder to dig with a

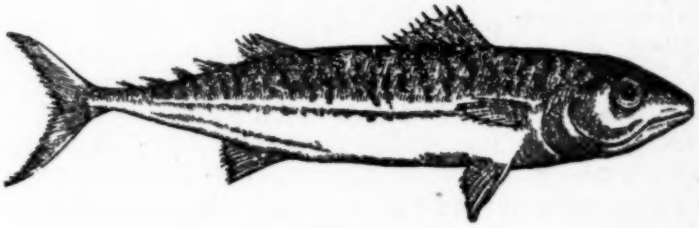

Fig. 10.

shovel than the undisturbed ground around them. Thus securely protected from wind, rain, and cold, and rolled up in balls, like hedgehogs, they sleep through the whole winter, without food or drink, till spring comes again. Five, seven, nine, eleven, or even more, are often found thus sleeping in one nest. The proverb "He sleeps like a marmot" is applied to lazy people by the inhabitants of these regions. Even when kept and fed in houses, they sleep through the winter. That very learned man Dr. Conrad Gesner says that he fed one for some time in his house, and at the beginning of winter, about the time when it should have gone to sleep, he put it in a small pine barrel, which he half filled with straw and then closed up tightly with the head belonging to it, to protect his pet from the cold. When he opened the barrel after many days he found the animal dead. He thinks it was suffocated and that it might have lived if he had made a hole in the barrel, although he is very much astonished by the result of his experiment, and does not now see how they can survive in their nest when the holes are plugged up.

They make use of a peculiar device for bringing home their hay. If they have gathered a great quantity they need a wagon to carry it, and one of them lies down on his back and, lifting his feet toward heaven, forms supports like those of a hay wagon, between which the others pile the hay. When the cart is loaded, the other marmots take the tail in their mouths, drag their brother home like a sled, and, after unloading him, put the hay in their holes. As each one takes his turn of service as a sled, none of them have any hair on their backs at this season of the year.

So long as it is awake this animal is rarely idle. It is always busy carrying hay, straw, etc., into its nest. It fills its mouth with these things, and the amount it can stow away is incredible to one who has not seen it. What it can not get into its mouth it takes between its paws, and carries that too. It never soils itself with its urine or fæces, but either deposits them in the proper place in the burrow, or throws them away from its body. Johannes Stumpff says, in his chronicle, that the marmot always stinks in the summer before it gets fat.

OF ITS CLEVERNESS AND SWEET NATURE.—Occasionally they frolic in the sunshine before their holes like kittens or puppies, rolling themselves in balls and frisking and chattering to each other. When reared in the house they carry on their sports before the eye of man. When angry they bite viciously, but when they are once used to captivity they make man their playmate, and sometimes catch his lice like a monkey. Few animals become more familiar than this one. It sometimes bites the dog, which is too well trained to defend itself.

When the marmots gather in the meadows to play, one stands near the mouth of the hole on the watch for men or other ene-

FIG. 11.

mies, and gives warning of the approach of danger by a bark or a shrill, high-pitched whistle. As soon as the others hear this cry they run to the hole, tumbling over each other in their hurry, the sentinel standing guard till all are in.

In unfavorable weather they remain in their holes; with their high-pitched voices they give notice of changes in the weather as well as of the approach of danger.

THE USES OF THESE ANIMALS.—They are caught in the following way, during their winter sleep when they are nice and fat, by hunters, who sell their meat for money: In the summer the people who live at the foot of the Alps mark the holes with long sticks which will show above the snow in the winter. About Christmas they walk over the snow to these marks on broad wooden runners, carrying picks and shovels, with which they clear away the snow, and digging into the nests, catch them asleep without trouble, although one must not talk loudly or make much noise while catching them, for if awakened they burrow rapidly into the soil, throwing the earth between themselves and the hunter and making it hard for him to follow them. They are also caught in snares laid before their holes, and in many other ways. They are always found in odd numbers, as seven, nine, eleven, or even more.

FIG. 12.

The hunters who dig them up in winter notice the length of the cone of dirt with which the animal has plugged up the opening of its burrow, for if this is short the winter will be mild, but very cold and severe if it is several feet long.

THE FLESH OF THE ANIMAL AND HOW TO PREPARE IT.—They are fattest about the Christmas days, and are killed while asleep by cutting the throat with a knife, as calves or swine are slaughtered. They usually die without awakening. The blood is caught, and the animal is scalded with hot water, like a hog, to remove the hair, and is cleaned and made to appear white. The intestines are then taken out, and the body, filled with the blood, is roasted on a spit or is boiled with black pepper. The flesh is sometimes salted and smoked, and is then boiled with black pepper, turnips, or a pumpkin.

The salted flesh is better than the fresh, as the salt dries it and takes away its penetrating odor. It is always indigestible and heating, but it is good for women in their confinement and also for their diseases.

ITS USE IN MEDICINE.—The stomach of the marmot is used as a remedy for stomach ache, and the fat for sclerosis of the arteries, which are rubbed with it.

THE WORK OF THE NATURALIST IN THE WORLD.*

By Prof. CHARLES SEDGWICK MINOT.

THERE can be no broader question, touching us all, than the influence of our profession upon the world. With your permission I will present a series of considerations in regard to our professional careers which ought, in my opinion, to receive more attention than hitherto. I am aware that in doing this I depart very far from our custom, your previous presidents having each dealt with some broad but specific problem of natural history in their formal addresses. I must leave it to your judgment whether or not I have done wisely in not following, in the present address, the example of my distinguished predecessors.

The object of the naturalist is to discover the truth about Nature, and to record his discoveries in a form which will render them available to others. Original research is the pivot of knowledge.

We will examine:

First. The conditions of success in research.

Second. The effect of the naturalist's career on his character.

Third. The influence of the naturalist on mankind.

I. The Conditions of Success in Research.—That the fundamental condition is the love of truth goes without saying. It is an axiom which, before this audience, requires no proof. But, though we all acknowledge Truth to be our sovereign, I fear there is not one of us whose loyalty to her is perfect—not one of us who can say that his allegiance to the truth has never swerved for the sake of competing influences. Yet Truth is the most absolute of despots, and if any man adheres to Error instead, Truth will triumph over him at last and rob him of all the honor which he thought to win. The disloyal investigator may for a time win honor, but in the end the falsity of his claims becomes known and his reputation shrivels. In our own time we have seen the German founder of brilliant embryological theories lose caste because he did not have the discretion to wait to learn whether his ideas were true. Certain great naturalists have suffered in reputation from their inability to accept Darwinian theories, for, had it been possible for them to join with Darwin, their greatness would be to us still greater. A man may be of the highest ability, yet will he rank low among naturalists unless he is quick and sure in his recognition and inflexible in his devotion to truth.

Perfect truth is our ideal, but we encounter so many, many

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* Presidential address delivered before the American Society of Naturalists at the annual meeting in Baltimore, December 27, 1894.

obstacles that we do not attain the ideal. The practical question is, What are these obstacles, and how may they be removed, avoided, or overcome? We undoubtedly make many failures, which are inevitable, and for which we are not responsible; I mean such failures as are due to the present limits of scientific knowledge, and the lack of the methods and instruments of research, which are as yet in the future. Nevertheless, the majority of failures to find the absolute truth are due to our own personal deficiencies. It is to the correction and, if possible, removal of these deficiencies that our professional training is very rightly directed.

The naturalist should be trained in observation, experimentation, and in reasoning.

Observation is our mainstay, the foundation of all our work. I believe that in many of our laboratories a student becomes well disciplined in observation, and acquires practical acquaintance with the principal sources of error in observation in his special line of work. This part of the naturalist's education is the part best done, and we must regretfully admit that his training in experimentation is almost nil, while his training in reasoning power leaves very much to be desired.

I should like to plead before you for experimentation. It is a most difficult art—far more difficult than that of observation, because the possibilities of error are far greater. The observer inquires "What?" the experimenter "Why?" The experimenter endeavors to determine an effect and a cause. He seeks, if you will allow me the expression, to find two "whats" and their mutual relation. Every science begins with observation, and, when it is advanced enough, takes to experiments. Natural history is still in the descriptive stage. The statement is almost strictly true of meteorology and zoölogy, nearly so of geology, least so of botany. I attribute so great value to experimental work that I regard botany as being at the present time the most valuable of the natural-history sciences from an educational point of view. As regards the zoölogists—with whom I must be counted—we are most of us either systematists or morphologists. Such experimental physiological work as has been done stands not to the credit of zoölogists, but almost entirely to that of medical men. In the slow advance of experimental morphology, through the labors of Driesch, Hertwig, Morgan, Roux, Whitman, Wilson, and others, we have the initiation of a most significant and beneficent reform. In all natural-history departments the great work of the future will, I believe, be done by experimenters.

For this reason it is to be desired earnestly that all young naturalists should be disciplined in making experiments. When that is done we shall hear less phylogenetic speculation and more

of true causes. There are still many morphologists who feel that they have somehow explained matters when, for example, they state that the human embryo has gill-clefts *because* man is descended from a fishlike ancestor. In reality such a statement is no explanation of the causation, any more than it would explain vegetable humus to say that it is due to vegetable matter deposited on the ground. Such assertions may be true, but the omission of all links between the initial cause and the terminal effect shows that the notion of causation is in its rudimentary stage. There are too many naturalists who have still to develop a just conception of cause and effect; and it is just this development that we must look for in connection with experimental work. The biologists especially ought to profit more than they do by the opportunities offered in physiological laboratories.

The reasoning faculty is our weak point. Of the late Prof. Helmholtz, his friend, the physiologist Carl Ludwig, once remarked to me, "*Er ist eine reine Denkmaschine.*" It was the possession of a superlative reasoning faculty that rendered Helmholtz to many of us the foremost scientific man of his time. Most of us certainly find that, when we try to reason, our reasoning is disturbed by various personal factors, and, though we know that emotional factors must be eliminated from intellectual processes if our conclusions are to be sure, yet experience has taught us that logic in our practice is rarely divorced from all emotion. Sound reasoning involves the character of the individual. To train a naturalist, it is even more important to perfect his character than his intellect. For this reason no teacher can deal advantageously with more than a few students, because he must understand the individual characteristics, and give each man personal guidance, which necessarily is different for each student.

Let us consider some of the factors which are most apt to disturb or distort the work of reason.

First and foremost is the love of one's own observations and opinions. If it takes the form of pride, which leads us to be so careful that our opinions deserve trust, well and good; but if it is merely an excitable vanity, it lures us to disaster. Think of the innumerable controversies of science, and tell me how often have the disputants cared less to prove themselves right, than to ascertain the truth, be their own opinions right or wrong. What we strive for and, I fear, never attain is perfect indifference to the sources of an idea. It is almost impossible not to feel an undue interest in our own idea, yet such an interest inevitably leads to overvaluation of the evidence in favor of our idea, and undervaluation of the evidence against it. Let us, therefore, avoid polemics, and so avoid the temptation to search for proof of a personal theory, when we ought to search for the truth only. Never let a pupil

say: "I am sorry it did not turn out thus and so; it would have been so fine if it only had been so." Let him be glad at discovering the truth. When he is eager for controversy, teach him the difference between discussion and controversy, and keep him out of the latter. Point out to him that erroneous conclusions are to be set aside, not so much by disproving them as by demonstrating the true conclusion. Darwin's theory of pangenesis has been set aside, not by being disproved, but by the demonstration that the theory of germinal continuity is well founded. The cataclysmic theories of Adam Sedgwick and the older geologists have been overthrown by the accumulated proofs of the gradual character of geologic changes. An error is hard to kill, but with a truth you may drive it away; therefore research is better than controversy.

The love of one's own opinion is the most insidious and fruitful of all sources of human error, and accordingly we recognize vanity and self-conceit as the gravest of defects in the naturalist's character. It is easier to make a competent investigator out of a dull man than out of a conceited man.

A second source of error is impatience—impatience to get results before the data are sufficient to support conclusions. What a horrible record against this century has been piled up by the accumulation of "preliminary notices," "*vorläufige Mittheilungen*, and *notes préventives!*"—a vast mass of mistakes, a terrible impediment to science, and all to gratify the mad longing for priority. I wish that the publication of a preliminary notice to secure priority should disqualify for membership in this society, and I trust that every one of us will stand firmly and sternly against this abuse, which is doing more to degrade science than any other influence I know of. Indeed, I am almost ready to say that the Académie des Sciences at Paris has done more against science than for science, because in its Comptes-Rendus it initiated the custom of brief premature publication for priority.

A third difficulty in the way of reason is the tendency to speculate. The annual waste of cerebral protoplasm in speculation must amount to millions of pounds. A vast generalization has its allurements, but in yielding to them we are apt to be drawn away from the actual facts. There is another danger, for the mere lapse of time gives hypotheses a dignity and apparent worth, and it were easy to give illustrations. You are doubtless all familiar with the hypothesis of *panmixia*, which was advanced on the flimsiest of bases; yet a few years later its propounder treats it as an established law. The like misfortune might happen to any of us, since it is easy to remember the conclusion and to forget the evidence. Among zoölogists speculation has long been rife, and for many years we have been deluged with phylo-

genetic inferences, with the evil accompaniment of eager welcome for facts which agree with the favorite phylogenetic theories of the day, and of disdain for such facts as did not concord with these theories. Thus has been created that biological mythology against which Prof. E. B. Wilson has protested so suitably.

Philosophy and science are practically often incompatible—not because philosophy is unworthy of our entire respect, but because would-be philosophers are not seekers for wisdom but lovers of speculation. Twenty years ago we thought that Oken, whose *Natur-philosophie* was created by his speculative enthusiasm, would never have another imitator, but since then biological speculation has become almost a fetich. Let us part company from the horde of foolish thoughts which have too long masqueraded under the false garb of philosophy. For our lifetimes the labor of inductive research will suffice, and we may well leave deduction for future generations. Philosophy, so called, is often an effort to decide what must be, but while knowledge remains imperfect the "must be's" will guide us wrong more frequently than they will guide us aright. As long as Science seeks to determine what *is*, her work will endure. My protest against speculation is no idle rhetoric, for the evil is very great. I hope that Weismann's mystical treatise on Germplasm will prove to be the culminating effort of the speculative school, and that the influence of the school will be as brief as it has been widespread.

A hypothesis may be a good serving maid to clean away rubbish and get the workroom in order. It is for us to remember that this good maid makes the worst mistress.

There are many other difficulties of character which obstruct reason, but you will excuse me from an exhaustive review of them, and therefore I will refer only to one more, and that briefly. I mean the artistic perception which induces us to look for completeness, clearness, and simplicity, so that we are tempted to add a little or more to our conclusions, or to accept a result partly because it is complete, clear, and simple. The most eminent illustration of this tendency is Herbert Spencer, whose mental processes are so far governed by his love of clear, simple formulæ that he uses simplicity as a test of his conclusions, and makes formulation a test of truth and a substitute for proof. We are all inclined to be lax as to our proofs if the generalization is satisfactory and pleasing, but Spencer's mistakes may warn us against the danger of gratifying this inclination. Science is not one of the fine arts. Its work can not be directed by the love of beauty or by sentiments. Science is a pursuit for the intellect and for the intellect alone.

I will turn to another part of our work—publication. Scientific publications naturally group themselves in four classes: origi-

nal memoirs, handbooks, text-books, and bibliographies. Now in the three latter good workmanship is indispensable, for their utility depends on their arrangement, the right proportion of parts, and the skillful use of language; but the value of original memoirs depends upon the discoveries which they report and the sufficiency of the evidence presented to support the discoveries claimed; hence the form in which the matter is presented appears less important than in a handbook or text-book. Moreover, our original memoirs, saving a very few which mark epochs of progress in natural science, are, as we all perfectly know, destined to oblivion. In time our new discoveries will become old-established facts, the original authorities for which will be forgotten. Who of us would search, save as a student of the history of science, for the original authority on the muscles of the human arm, or for the proof that fossils are not *lusus naturæ* but genuine remains, or that some rocks are of sedimentary origin? When we have attained certainty in our discoveries, they gradually become so verified that the memoirs, which originally brought the proofs, lose their value. Original memoirs are like digestive organs; they are filled with raw facts, which they prepare for assimilation, but to build the body of science these same facts must be absorbed and transmuted.

We are, of course, convinced that our original memoirs are for temporary service, though their recorded facts are to be permanently added to knowledge. To the influence of this conviction we may ascribe that carelessness of style, verbosity, and frequent padding which mar scientific writings too commonly, because the necessary care does not appear worth while for a temporary essay. But the time has now come when the burden of reading the thousands of pages of memoirs which are published annually even in a single field of research is overwhelming, and it is evident that for the advantage of science every legitimate means to lessen this heavy burden should be adopted. The habit of conciseness and clearness should be sedulously cultivated.

With a view of estimating what might be done in this direction, I have gone over a number of articles upon embryology which have been published in the four accepted languages of science—German, English, French, and Italian—during the last two years. I am compelled to admit that the majority of these articles could be easily shortened by a half, and many of them shortened by much more than that, and still offer a thorough, or, better, said an exhaustive account of the matter presented. I have been astonished at the amount of perfectly irrelevant matter and of personal details which appears. The author informs us that he could not leave home until Tuesday; that it rained on Friday; that he had to carry the eggs eleven kilometres on Saturday;

that he used Delafield's hæmatoxyline solution, of which he gives the formula; that he began making his sections with a Thoma microtome, but later used a Schanze, as Prof. X—needed the Thoma; the author's work was interrupted because he was called home on account of his father's illness; his father lived in Meyerstadt or Smithville. What have these and thousands of similar items to do with the plane of the first cleavage of the ovum, the origin of the centrosome, or the development of the notochord, or any other problem of embryology? I have not invented my illustrations; on the contrary, I have taken them from some of the best of recent embryological articles. Similar illustrations can be collected from recent literature of any branch of natural-history research.

So far as embryological literature is concerned, the French standard is certainly the lowest. Their verbosity is infinite, and one must read page after page for a single fact. Many of the French memoirs I have read are literally ten times too long for the matter. Next to the French come the Germans and ourselves —Americans—who, in the biological sciences, are disciples of the Germans. The best-written memoirs are the English, owing, I think, to Huxley's influence. Huxley has carried scientific writing to unsurpassed excellence, combining clearness and brevity in a marvelous way, and his pupils, Francis Balfour and Michael Foster, have invariably sustained a high literary standard. Their example has been all the more telling because literary art holds the same position in England that music holds in Germany and painting in France.

No doubt the ark of science will traverse the deluge of publication safely and land us on the Ararat of natural law, but I fear our Ararat will not appear until the deluge subsides.

But I must hasten to the second part of my address.

II. THE EFFECT OF THE NATURALIST'S CAREER ON HIS CHARACTER.—The occasion does not permit me to refer to more than two or three professional traits.

The best that we gain from the pursuit of research is, I believe, our characteristic optimism. We are engaged in achieving results, and results of the most permanent and enduring quality. A business man may achieve a fortune; but time will dissipate it. A statesman may be the savior of a nation; but how long do nations live? Knowledge has no country, belongs to no class, but is the might of mankind, and it is mightier for what each of us has done. We have brought our stones, and they are built into the edifice and into its grandeur. My stone is a small one. It will certainly be forgotten that it is mine, nevertheless it will remain in place.

How different is the pessimism toward which literary men are

seen to tend! Harvard University lost James Russell Lowell in 1891, and Asa Gray in 1888. The letters of both of these eminent men have been published. Lowell's letters grow sad and discouraged, and he gives way more and more to the pessimistic spirit. Gray is optimistic steadily and to the end. The difference was partly due to natural temperament, but chiefly, I think, to the influence of their respective professions. The subject material of the literary man is familiar human nature and familiar human surroundings, and his task is to express the thoughts and dreams which these suggest. He must compete with the whole past, with all the genius that has been. There is nothing new under the sun, he exclaims. But to us it is a proverb contradicted by our daily experience.

The attitude of literary men is indeed sad. Lowell opens his essay on Chaucer with the question, "Can any one hope to say anything, not new, but even fresh, on a topic so well worn?" and answers, "It may well be doubted." This feeling that anything new is impossible is not modern. La Bruyère begins his Caractères with "Tout est dit, et l'on vient trop tard depuis plus de sept mille ans qu'il y a des hommes, et qui pensent"; and two hundred years later Joubert repeats: "Toutes les choses, qui sont aisées à bien dire, ont été parfaitement dites; le reste est notre affaire ou notre tâche: tâche pénible."

Another trait which is very striking shows itself, not in all naturalists, but in nearly all great naturalists—the trait of humility—not the humility of self-depreciation, but the humility which is the privilege of those who pursue a high ideal. The great naturalist cares for the absolulely true, and, though he may know that he is abler than other men, he feels only a minor interest in personal comparison, and measures himself by a different standard. A man who estimates himself by an ideal which he never fully attains, learns humility in its noblest form. Von Baer, Ernst Heinrich Weber, Helmholtz, and Darwin were men of that rank; and doubtless the very greatness mentally of such men enables them to estimate justly the proportion their personal contributions bear to the whole of science.

The sad side of an investigator's life is its inevitable loneliness, so far as his special work is concerned. It rarely happens that one of us finds a colleague at hand able to appreciate his special work; but at these meetings we each find appreciation and stimulus, and we return refreshed to our isolated labors, return stronger to stand by ourselves, as men must who wish to share in the serious work of the world.

The solidarity of our profession, the mutual loyalty not only of naturalists but of all scientific men, is very great and of immense value. It is perhaps the most important function of this

society to maintain and strengthen our professional loyalty, because upon that loyalty depends our success as a body, and as a body we have a great work to do. Loyalty implies generous co-operation, and secures that unity of feeling and action which breeds success. Our influence is not yet large enough, and I hope that it will be vastly increased by carrying out the scheme of affiliation between ourselves and kindred societies. Unity is power.

It is believed by many outside of our profession that a scientific career is narrowing in effect, and tends to obliterate human, artistic, and religious interests. They look upon Darwin's loss of sympathy with poetry as typical. The idea seems to me false. The naturalists whom I know are as genuinely interested in their friends and in art and in literature as any other group of liberally educated men. One of our foremost geologists is a learned musical enthusiast; one of our botanists, a loving student of the best European literature; one of our anatomists, an earnest participant in charitable work. I claim, in short, that the pursuit of pure science broadens and deepens the character. Science is full of sublimity, of charm, of inspiration; but the poet has not yet been found who will express this aspect of science. We are like colonists: our pioneers are continually advancing into new territories; we must work incessantly to secure mere possession; so it is not yet quite time for the poet.

Another characteristic of the naturalist is faith. He must preserve his faith in the possibility and value of knowledge of the truth. We often forget that this necessity exists. Although we know not whither truth will lead us, whether to happiness or to unhappiness, we nevertheless believe in it, trust in it, and strive for it. Let us therefore have a broad-minded respect for the faculty of faith, for the loss of it is a crushing disaster to a naturalist.

The loss of faith in the truth is rare; its opposite, an exaggerated confidence in the possibilities of science, is not rare. I think that we habitually measure science incorrectly, because we estimate its magnitude by our individual capacity for knowledge, and so come thoughtlessly to call that infinite which is merely large. I hold the opposite conception, that the extent of possible human knowledge is comparatively small so soon as we omit the details. Huet, Bishop of Avranches, thought that the real knowledge of his time,* aside from the details of history, etc., could be put in ten folio volumes. He was probably not far from right. All the knowledge of our time could be brought within the compass of a moderate number of volumes. Nor does the future ap-

* The latter part of the reign of Louis XIV.

pear to me to offer more than very finite possibilities. Discovery can not always go on with its present rapidity. We live in the golden age of research. We are surrounded on every side by discoveries so easy that they seem to beg for our attention. But as each one is made and its result added to the known, the unknown is equally diminished. It diminishes daily, and the store of easy discoveries lessens so fast that the time is not very distant when investigators of moderate abilities will no longer enjoy such opportunities as they have now. If we consider the whole of science, we have a sense of boundlessness; but each part has its end, and its end is not far away. It will not be long before nearly everything easily known will be known. It would be presumptuous to assume that, even when the whole knowable has become known, there will not still be problems which the human intellect can apprehend but not solve. As to-day, so hereafter, the naturalist's final thought must be reverent submission.

III. THE INFLUENCE OF THE NATURALIST ON MANKIND.—The influence and utility of natural science need neither defense nor explanation to a generation which has witnessed the establishment of the theory of natural selection and of the germ theory of disease; nor need we argue for the pre-eminence of original research, but there are certain principles for which we stand individually and collectively. I think that it will be profitable to review and to formulate some of these.

We stand for the value of good intellectual work and for the recognition of the value of proper training. We do not admit that scientific work requires a peculiar mind, but only the cultivation of those fundamental faculties of observation and induction which every one should possess and use. On the other hand, we claim that in addition to the development and disciplining of these faculties the naturalist must have his special professional training, and that without it he is not qualified for his professional work. In upholding this standard we not only serve the cause of science, but we serve the whole country. It is safe to say that the greatest evil in the social life of the United States is the habitual disregard of competency—a disregard which prevails not only with the people at large, but also among the most highly educated men. Democracy is the belief that every man is the equal of his betters. Americans are loath to admit that training and experience make experts, and that experts are better than others for their special work. The spoils system of the office-seekers is based upon the assumption that training and experience do not render a man more competent. When a water board is established to plan a water supply, we do not appoint chemists, engineers, and sanitarians, but grocers, novelists, and ward politicians. It is a rare exception if among the trustees of

endowed educational institutions a man is found with extensive knowledge of educational methods. It is common for a man who has never been trained to teach to take up teaching for a few years, when he changes to some business or profession. These, and thousands of other instances, crowded in our memories, illustrate the dislike of real competency.

Imagination anticipates the revolution which must come, and foresees the time when public workers of all kinds shall be chosen —first, because they have been properly trained and educated for the work which is to be their lifelong profession; second, according to the relative ability of those so prepared. Democracy appears as a permanent factor of steadily increasing influence in social evolution. It has, of course, done much good, but its failure to secure honest government has raised one of the gravest problems of our time. Some persons advocate restriction of the right to vote, but to me restriction of the right to be a candidate offers the practicable solution of the problem. We are a few among millions, but the educational and other offices we hold give us an influence out of proportion to our mere numbers. If we demand within the limits which becomes us that men must be chosen for their competency, we shall uphold effectively a principle the defense of which is among the foremost duties of every patriotic citizen.

We have already done something to improve school education. We should do more, especially in the direction of adding scientific courses to the school curriculum. A man is liberally educated when he has learned to take an appreciative interest in the intellectual life of his time, and a man who has not learned enough of the natural sciences to understand something of their progress can to-day scarcely rank as an educated man. It is true that science is better adapted to serve as a basis of education than the classics, and it is true also that it is easier to give a liberal education without classics than without science; nevertheless we must urge the claims of science in schools conservatively. A reform is better than a revolution. A reform saves strength and spares prejudices. We must remember, too, that centuries have been spent in testing and perfecting the classical system of education, and that it has rendered services which can hardly be overestimated. The education based on science has scarcely two decades of imperfect and hesitating trial, and the people at large have still to learn that it is feasible and more valuable than the older system. The methods of utilizing science for school courses are still crude. We suffer from an *embarras des richesses*. There is here an opportunity for public usefulness for this society. Could we not through a committee prepare a plan for a system of school education in which science should have its place, and

by which our children should acquire some information about themselves, the world around them, and at the same time be disciplined in observation and reasoning?

In regard to our schools there prevails the miserable delusion that they are good. We have many private and public good schools, but they constitute the small minority. Most of the young men who enter my classes after leaving our public schools are poorly disciplined in every respect, and a great many of them are absolutely uneducated: they can not express their thoughts in English; they can not spell common words; they can not translate correctly a simple phrase in Latin or any modern language, and they are ignorant of all sciences. Such is too often the condition of the graduates of the primary, grammar, and high schools of the country which claims to afford the best system of public education in the world. I have very little personal acquaintance with our schools, but to my mind their product condemns them, and I believe that our influence can do much to redeem them from their present condition.

Another public duty, which belongs especially to us, is to advance the development of universities in America. There are three grades of education—school, college, and university. In schools elementary knowledge is used to inform and develop the mind; in colleges advanced knowledge is used for the same purposes. Now it is one thing to teach what is known, as in schools, and to teach how to confirm what is known, as in colleges; but it is a fundamentally different task to advance a student to successful original investigation of the unknown. As Mill has justly remarked, the vast majority of mental operations are neither inductive nor deductive, but reasoning from particular to the particular. Minds which work in this way suffice for the routine affairs of existence, but the progress of the world depends on the higher faculty of originality, either in the inductive establishment of laws by the comparison of particulars or in the deductive applications of these laws. It is the function of universities to develop and discipline originality, to cultivate the faculty of thinking out a conclusion for the first time—not for the first time in the history of the thinker, but for the first time in the history of the world.

To train men to originality in every field of production is the proper function of a true university. This has long been the accepted ideal of German universities, and because they have steadily striven for this ideal they have attained a fame which draws to them students from every other country. In America we are slowly creating a few universities. Of nominal universities we have too many—false *Duessas*, fair in semblance, but not true to their pretensions. We have, in fact, as yet nothing to

rank with the German universities. We are handicapped by the college tradition of four years' education to fit a man for everything in general and nothing in particular. But the colleges are rapidly losing ground, and it seems to be only a question of time as to their total disappearance. I do not mean that they will cease to exist in name, but that a college (in the sense of the term as universally accepted thirty years ago) is an institution which will have no place in the American educational system of the future, just as it is unknown in the present educational system of Europe. In fact, our best colleges are passing through rapid revolutionary changes, and, like Harvard, Yale, Columbia, and others, are becoming universities. Let it be our part to help the transformation, to hasten it, and to secure for research its place as the basis of the highest education in science. Every one admits that the value of a university depends chiefly upon its professors, but it is not understood that ability to give instruction six to ten hours a week successfully by no means qualifies a man to be a university professor. The essential qualifications for a professor of any natural science are, first, ability to carry on original research; second, ability to train others to carry on original research. All other qualifications are subsidiary. Of university life research is the Alpha and research is the Omega.

We welcome the growth of the university idea in this country, and we can not gather in this place without speaking with grateful recognition of the services rendered to the cause of the highest education by the university whose guests we are to-day. The Johns Hopkins University has the glory of having been the first American institution to accept unreservedly the genuine university ideal. Would that she had had more imitators!

SUMMING up the conclusions announced by Mr. Worthington C. Smith in his book, Man, the Primeval Savage, Dr. W. Boyd Dawkins agrees with the author in the opinion that man inhabited southeastern England after the Glacial period; also in the view that the preglacial or postglacial age of man is to be regarded as merely of local significance, because the Glacial period is a purely local phenomenon, not marked in the warmer southern lands, such as the Indian Peninsula, which was inhabited by the palæolithic hunter. "We know him in India simply as living in the Pleistocene age. He probably invaded Europe in the preglacial age, and lived in the south while Britain lay buried under a mass of glaciers, or was covered by a berg-laden sea. He is postglacial in the valley of the Thames. He is not separated from our own times either by a wall of ice—the ice age of Prof. James Geikie—or by the tumultuous waters of a vast deluge, such as that recently put before us by Sir Henry Howorth. He is separated by a geographical revolution during which the seaboard of northwestern Europe, as we find it now, came into being, and Britain became an island—as well as by a change in our land from a continental to an insular climate."

BUSINESS, FRIENDSHIP, AND CHARITY.

By LOGAN G. McPHERSON.

AS man has learned with increasing complexity of means toward an increasing variety of ends to wrest food and fuel and shelter from the earth and all that springs therefrom, each man has had to depend more and more upon the efforts of his fellowmen; and hence has arisen that marvelously intricate intertwining of effort that characterizes the civilization of to-day. Interwoven in ministering to the needs and gratifications of mankind are the laborer's muscle, the hand of the mechanic, the brain of the merchant, the painter's touch, the singer's voice.

This intertwining of effort is nowhere separable; the result is the blood of civilization that, flowing through the arteries of commerce, connects the hemispheres. Europe and America eat the cattle and the wheat of the western plains, wear the fabrics of England and France, and drink the tea of the Orient. The results of the researches of the German laboratory, and of the inventor of whatever nation, are utilized throughout the world, and books of whatever press penetrate to the households of every clime. Patti sings in San Francisco and St. Petersburg; Irving and Booth act in Berlin, Paris, London, and New York. In public gallery and public park the masterpiece of painter and sculptor is seen by thousands, and, as reproduced by engraving and etching, is brought to the sight of thousands more. The English specialist discovers a remedy that all physicians use; the American lawyer collates, systematizes, and formulates a code that eases the burden of all litigation.

In the simplicity of primeval life each man obtained for himself his own crude subsistence, prepared his own rude clothing, and fashioned his own rude tools. In time it was learned that, by yielding a portion of the result of one's efforts for the benefit of another in return for a portion of the results achieved by that other, increased benefit was obtained by each. Thus began that co-operation that, through the centuries of slavery, feudalism, and absolutism, has increased and extended until to-day all who by work of hand or brain achieve results that contribute to the benefit of others receive the measure of their material reward in money obtained as wages, salaries, fees, or profits.

The man of affairs, before taking the morning train that conveys him to his place of business, gives a penny to the boy at the station and receives in return a newspaper. In exchange for that penny he receives knowledge of the happenings of the previous day, which may play a part in determining his course in connection with the production and distribution of commodities that

may directly affect hundreds of workmen and thousands of consumers. The boy who receives the penny receives many other pennies, a portion of which accrues to him as his profit from the sale of the papers. The greater portion goes with hundreds of other pennies, from each of hundreds of other boys, to the office of the newspaper, where they form a considerable portion of the fund that pays for the paper whereon, and the ink, type, and presses wherewith, the newspaper is printed; that goes in wages and salaries to the foreman, compositors, correspondents, and editors. The portion of this fund that goes to the manufacturers of ink, paper, and presses contributes to their profits and to the wages and salaries of the workmen employed by them. Portions of the wages and salaries of foreman, compositors, correspondents, and editors, and of the workmen that make ink, paper, and presses, are in turn paid by them to dealers in shoes, hats, clothes, meat, flour and potatoes, coal, furniture, carpets, and so on. The dealers in these commodities make remittances to the manufacturers who in turn, pay the wages of the workmen who produce shoes, hats, and clothes; to the killers of cattle; the packers and shippers of meat; the raisers of wheat and millers of flour; the miners of coal; the makers of furniture, and the weavers of carpets. Each is a purchaser of products that all are concerned in producing. The money that goes to each as a reward for his efforts is distributed through various channels to all others as a portion of the reward for their efforts. The exchange of the penny and the paper between the man and the newsboy is one of a myriad of exchanges between man and man that are interlinked one with the other in bringing to each a portion of the benefit of the efforts of all the others, and which, giving a broad significance to the term, constitute Business.

Without this interlinking of effort the fabric of our civilization would be impossible. Not under any conceivable conditions could any one family supply its needs as those needs are supplied by the various producing and distributing agencies of to-day.

With the increasing interdependence of man and man in ministering to material needs has been an increasing tendency toward association for that satisfaction which is obtained from the common enjoyment of a pleasure, the sharing of grief, the expression and exchange of thought and opinion, from social conversation. Association, from necessity or convenience, frequently develops a similarity of taste and habit that brings congeniality; the wider the range of association permitted by the conditions of their lives, the greater is the opportunity for persons of particular tastes and habits to form companionships affording the greatest gratification, and the likelihood that they will do so. With the congeniality thus formed is the growth of sympathy of one

with the other, and this sympathy or fellow-feeling is the basis of that relation known as Friendship. This sympathy, leading to the desire on the part of those between whom it exists that the life of each shall be free from discomfort and annoyance, prompts the doing of kindly acts one for another. These acts are frequently the dispensing of hospitality; they frequently are the extending of aid in misfortune and adversity, and, now and then, result in the sharing of fortune, to a greater or less extent, by one more richly endowed with the means for the satisfaction of his material needs, with those to whom he is bound by this sympathy of friendship. It will be perceived, therefore, that when a person, prompted by this sympathy, contributes to the material welfare of another, that other receives from his gift benefit that he might not otherwise obtain, except as the reward of effort toward the satisfaction of the material needs of mankind. Thus friendship bestows what otherwise would not be obtained but through the channels of business.

Akin in a measure to that sympathy which prompts acts of kindness which inure to the benefit of one's friends, is that sympathy which prompts acts of charity intended to inure to the benefit of the needy and unfortunate—of those who, whether by reason of bodily, mental, or moral defects, or by the grinding force of untoward circumstance, live in misery. The giving of alms to a beggar, the contribution to a hospital, asylum, or missionary fund, springing from this feeling of sympathy, have directly or indirectly for their object the bettering of the material condition of the beneficiaries.

As the actions prompted by the desire for pecuniary gain, many of the actions prompted by friendship, and the actions prompted by charity have for their object the satisfaction of the desires of others, the conferring of benefit upon others, it is proper to consider to what extent, in what manner, and under what conditions one should confer benefit upon or receive benefit from others.

It has been demonstrated by the greatest philosophers that the highest end to be attained by each individual for the good of himself and the good of civilization is the greatest harmonious physical, mental, and moral development of which he is capable. The benefits conferred by each individual upon others should therefore be such as to lead to this end for each of the beneficiaries, and the benefits received by each individual from others should lead to this end for him.

To its wholesome use, as well as to its highest development, is essential that the body receive that food and clothing and the bodily organs that alternate exercise and rest that promote regularity and fullness of the vital processes; that nerves and muscles

receive that training which brings them under the complete control of the will; that the perceptive organs be habituated to convey clear and accurate impressions to the brain.

To the wholesome use of the mind it is essential that the impressions coming thereto be perceived in their exact relation, so that nerve and muscle may be directed to most efficient result; its development means the more extended and the more complex correlation of an increasing number and variety of impressions.

The highest moral development is attained through the increasing and constantly more refined perception of that conduct which contributes to the highest good of one's self and others, and action in accordance therewith.

Here arises the fact that the physical and mental structures of different individuals are of greatly varying capacities. An amount of physical exertion that serves only as wholesome exercise to one man might ruin another of less sturdy structure. The amount of mental exertion upon which one brain thrives and develops would cause another pain, and would be utterly impossible for yet another. Different impressions coming under different conditions, through bodies of different fiber, to brains of different caliber, have, together with the mold given by differing influences of heredity, produced that difference of characteristics in different individuals that is so incalculable that it is accepted as a truism that no two persons are exactly alike. It is obvious, therefore, that no one can contribute to the totality of effort in greater degree or in kind other than his physical and mental structure and characteristics will permit. The laborer on the embankment has the muscle wherewith to use the pick and shovel, but ordinarily is incapable of that co-ordination of hand and brain which would enable him to use tools of a higher class. The blacksmith has that adjustment of brain and muscle which enables him to bend and shape the bars of iron. Through the ascending ranks of artisans this adjustment of brain and muscle becomes more delicate, reaching a rare degree of precision in, for example, the optician who grinds and shapes the glasses for spectacles, microscope, and telescope. The clerk who keeps journal and ledger, or who prepares deeds and mortgages, has that control of the hand and that mental development which suffice for this work. Neither laborer, blacksmith, optician, nor clerk could perform the work accomplished by the other; but each, by giving to others the benefit of effort of which he is physically and mentally capable, receives that which enables him to obtain the food, shelter, and clothing necessary to his maintenance.

And it is through work of body and brain that yet higher result is achieved. The blacksmith's son, compelled to contribute early in life to the support of himself, his brothers and sisters, be-

comes perhaps a machinist's apprentice. As he sweeps the shop, carries tools, and blows the bellows, he sees the firing of the boilers, the turning of the wheels and belts, and the men at their work. In time he comes to use tools and lathe himself. His hands become deft, and his brain increases in perception of what tools and machines can be made to do; he is being trained and developed, physically and mentally, to a capacity for increased usefulness, which brings increased reward. This development perhaps may result in the invention of appliances or the discovery of methods whereby greater results may be accomplished with less effort, thereby giving to civilization that extraordinary benefit and obtaining for himself that extraordinary reward which comes to the inventor. And so, likewise, with all men in all vocations. The printer's devil, step by step, may rise to the foremanship of the composing room, or to the editorship of the paper. The office boy becomes shipping clerk, or bookkeeper, and may acquire that knowledge of commerce and that judgment which fit him to control the operations of a great manufacturing or mercantile establishment.

Throughout the field of human effort, extraordinary achievement proceeds from a correlation of ideas in an original perception of far-reaching relation of cause and effect that, through nerve and muscle, results in handiwork or delivered word that places that relation in tangible shape for the benefit of mankind. And in any line of human effort extraordinary achievement is usually attained only after years of toil, in which body and brain are trained and tempered to this perception of far-reaching relation of cause and effect and the ability to give it expression. Different individuals, however, attain different degrees of usefulness, and different degrees of reward; only the few achieve extraordinary result, the vast majority in any vocation laboring year after year without more than average achievement or more than average reward. But the work of each brings that which sustains the body; it gives body and brain the use by which they are exercised and developed; it contributes to that totality of effort by which all individuals of the civilized world are sustained; and it is by means of toil that civilization is advanced; that better machines are made; that better cloths are produced; that more nutritious food is prepared; that better houses are built; that better books are written; and better songs are better sung.

In every community different people live in different degrees of comfort. Their habitations vary greatly in size, strength, and durability. Their clothing differs greatly in warmth and adaptability, and varies in quantity. There is great variety in the kind and quantity of food which each family can afford, and the

opportunities for other pleasurable gratifications of the senses widely differ. And therefore the question, Why do different individuals obtain from the totality of effort different proportions of benefit?

The reply is suggested by the actions of men in primeval barter. When man first learned that, by yielding a portion of the result of his efforts for the benefit of another in return for a portion of the benefit of the result achieved by that other, increased benefit could be obtained for himself, he naturally yielded only so much of benefit as would bring him greater benefit in return, and so also with the other. Each yielded as little and obtained as much as he could. In that intricate intertwining of effort that characterizes the civilization of to-day that primeval principle of exchange holds good. The wage of the laborer and servant, or the salary of the clerk, as a rule, is as little as can be paid for the work which each performs; likewise with the fees of the physician, lawyer, writer, painter; and, as a rule, the least consideration for which commodities can be obtained is the price that is paid for them. And likewise laborer, servant, clerk, musician, lawyer, writer, or painter, as a rule, endeavors to obtain the highest price for his services or the result of his efforts, and the merchant the highest price for his commodities. And this basis, which seems to be of unmixed selfishness, is the only basis that will lead to ultimate justice to all.

For if A produces the same quantity, quality, and result of work as B, and receives greater wages, salary, fees, or profits in return therefor, he is able to obtain from the efforts of others a greater proportion than B of all that contributes to the well-being of himself and of his family. That is, in return for equal contributions to the totality of effort A receives more than B, which is manifestly unjust. If there can be obtained from C, D, E, or F the same quantity, quality, and result of work as is obtained from B and for the same reward as is paid to B, society, as a whole, by paying to A a greater reward than it pays to B, C, D, E, or F, diminishes the totality of effort by the amount of effort that B, C, D, E, or F would produce in return for the difference between the reward paid to A and that paid to B, C, D, E, or F for the same result. If, however, society can not obtain from C, D, E, or F, or any other source, the same quantity, quality, and result of work as it obtains from B—except for a reward equal to that paid to A, and it needs a greater amount of such work than can be produced by B—it is obliged to avail itself of all or a portion of the efforts of A, C, D, E, and F. If it continues to obtain results from B equal to the result obtained from either A, C, D, E, or F for less reward than is paid to A, C, D, E, or F, B by reason of the discrimination has a grievance which is not ad-

justed until his reward is made equal to that paid A, C, D, E, and F. But if from B, G, H, I, and K work can be obtained equal to that obtained from A, C, D, E, and F for the same reward to each as that paid to B, the totality of effort would be increased by employing B, G, H, I, and K at the lesser reward. Society as a whole, therefore, receives greatest benefit, other things equal, by obtaining needed results for the least reward. But by paying unequal rewards for equal services it incites the antagonism of those discriminated against as soon as the discrimination is perceived by them. The merchant, who pays one clerk a greater salary than another whose services are of equal value, incites that other to the demand for an increase of salary. A class of laborers receiving wages less than other laborers to whose services they think their own equal, are incited to demand equal wages; and so throughout all society.

But if A and B for equal results receive equal reward, and in a given time A produces more than B, it follows that to make equal contributions to, and to receive equal reward from, the totality of effort, B must work longer than A. And if A in a given time produces not only more than B, but of more important result than B, it follows that his reward should be greater than that of B. In other words, to receive the greatest reward that he can obtain from the totality of effort, each individual should contribute to his capacity to that totality; and that the totality of effort may be the greatest, society must bestow upon each individual such proportion of benefit as in return for which the proportion of effort of which he is capable can be obtained.

And it is not difficult to perceive that the value of effort is directly proportionate to the intelligence with which it is guided and by which its results are directed. On roads and embankments, in the fields, mines, and quarries, is necessary a vast amount of work that depends almost entirely on physical exertion and endurance. While the aggregate of this work forms a large proportion of the totality of effort, the portion contributed by each individual is but an infinitesimal portion of the whole, and, as requiring but little intelligence or experience or training, it can be performed substantially as well by one as another the proportion of benefit accruing to each individual in return is small, and this also because such work is without avail unless it is directed to efficient result, and its results are co-ordinated to beneficial ends, and this directing and co-ordinating come from others than those performing the work. On the plane with these laborers may be classed teamsters, stevedores, porters, and like functionaries. For their individually slight and easily obtained services, which are immediately directed by the intelligence of others, society gives but slight reward. In stores and offices are needed the services

of multitudes of clerks, who, by helping purchasers to secure desired commodities, by writing letters and keeping accounts, contribute to the benefit of society effort that requires a considerable degree of intelligence in addition to manual labor. Their contributions to the totality of effort, and likewise those of artisans, such as carpenters and machinists, to the performance of whose work is necessary a considerable degree of intelligence, training, and experience, meet with ampler reward than those whose efforts spring from physical exertion alone. To those who direct the efforts of others toward results of great benefit to a great number of people still greater reward is given. The manufacturer, who employs the services of numerous employees in producing commodities of a design and quality that cause them to be of use to multitudes of people throughout an extended territory, and the transportation manager and the merchant who utilize the efforts of legions of subordinates in effecting their distribution, frequently amass fortunes. Those from whose brains spring ideas that are of extraordinary benefit to mankind, and those who have made practical utilization of such ideas, have received extraordinary reward. Instance after instance occurs of inventors whose devices have wonderfully cheapened and facilitated production and distribution, and who have thereby reaped immense personal gain. And likewise throughout the professions and the arts. There is a vast difference between the remuneration accruing to the lawyer of slight and unimportant practice and that to him who contributes to the adjustment and maintenance of vast and important interests; between the reward given the actor of little histrionic ability and that flowing in upon a Jefferson or a Booth. At the extreme end of the scale are the vagabond and the tramp, who, contributing nothing to the well-being of any one, are entitled to nothing in return.

Out of the different capacities of different men that have been accentuated by the increasing specialization by which alone it has been possible to administer to the growing and varied needs of mankind has arisen the present industrial system. Each man, to obtain the satisfaction of his own needs, must contribute to the needs of others; each man, in the endeavor to obtain the most for himself, strives for higher wages and salaries and for greater fees and profits; and all men, that they may supply their own needs to the fullest extent, strive to obtain services and commodities for the lowest price. Therefrom arises the great force of competition that, acting through the merchant who sells, upon the manufacturer who produces articles of use and consumption, compels production in best adapted localities, the adoption of economical appliances and thrifty methods, the placing of particular functions in charge of those best fitted to their performance. The in-

creasing use of machinery and the development of methods of production and distribution necessitate the employ of a constantly increasing, number of men of the higher grades of ability and intelligence and the efforts of other grades of those who work increase both in vigor and system toward securing the greatest remuneration for their services. The result, as amply proved by statistics, is that the reward of effort constantly increases both by reason that wages, salaries, and incomes become greater, and the prices of commodities and of the result of services become less. That this holds true even during the radical industrial readjustment of the past two years is evidenced by the following extract from the editorial summary of business in Dun's Review of January 5, 1895:

"The complete review of different branches of business given to-day places in a clear light the fact that prices of commodities are at the lowest level ever known. Eight years ago, in July, prices averaged only 73·69 per cent of the same articles and in the same markets January 1, 1860, and this remained the lowest point ever touched until August 10, 1893, when the average fell to 72·76, but early this year prices dropped below all previous records and have never recovered, the average December 26th being only 68·73 per cent of the prices in 1860. These changes contrast sharply with the decline of wages paid per hour's work, which, as was shown last week, average only 1·2 per cent less than a year ago."

It should, however, be perceived that the greatest contribution which any one can make to the totality of effort is not the result of effort pushed to excess in any one direction for a limited time, for such effort results in the premature impairment of physical and mental power; but the total result of his efforts for the longest time that his mental and physical efficiency can be preserved. It therefore follows that periods of expenditure should be followed by periods of recuperation; that each man for the benefit both of himself and of society should have that rest and recreation and the opportunity for that bodily and mental gratification which offset the wear and tear of energy persistently expended in one direction, and contribute to the preservation and symmetrical development and rounding of his bodily and mental life.

All the foregoing statement leads irresistibly to the conclusion that each man should work as best he can in fulfillment of his duty to himself and his duty to all others, whether his contemporaries or those who come after him. And therefore stands clear and firm the corollary that each man should find pleasure and satisfaction in that work which it is possible for him to do. And it doubtless would be so if throughout the world all people recognized the full meaning of work, and it were true, and

all people clearly perceived it to be true, that each man receives benefit in proportion to the value of his efforts. But all history shows that man has ever had to fight for the fruit of his labor; to stand guard over that which his efforts have gained. Herein lies the meaning of theft. In broad significance, to steal is to deprive another of benefit without yielding benefit in return. The robber and the thief that directly filch are shown to become less in each decade in proportion to the total population; but, in the complexity of the growing industrial mechanism, the greed of the unscrupulous has found new channels through which to wrest from others that for which adequate recompense is not given. But after war is peace, and as a wider sense of justice has followed the struggles of mankind in the past, there is reason to believe that the industrial warfare that now confronts us on every hand and the discussion of political, economical, and industrial problems which is now intense throughout the civilized world will result in that increased intelligence and increased morality which tend ever more and more to give each man his due.

And contributing to this end must be a fuller understanding of the nature of friendship and charity and of their just limitations. For these much-extolled virtues are but too frequently with mistaken intent devoted to unworthy ends; in devious ways their counterfeits are made to serve as instruments for obtaining unearned gain. That a monarch of old who gave to a genial comrade power to devote tribute obtained from the subjects of the realm to his personal pleasure and indulgence allowed friendship for his comrade to result in wrong to his people is apparent without other proof than that of the fact. Because of the pleasure obtained by the king from association with him, the favorite benefited by the efforts of thousands of people to whom he contributed no benefit in return. And so also with every man occupying position of power or trust who bestows place, authority, or privilege because of friendship upon a man incompetent and unworthy. For, as the efforts of each man are interlinked in greater or less degree with the efforts of all others, so to do would be to diminish the totality of effort that is the lifeblood of civilization. The human nature quickly adjusts itself to that which is pleasant; the frequent bestowal of unearned benefit upon a friend tends to adjust his nature to the reception of that benefit, to lead him to expect it. His perception of the fact that benefit should come to him in proportion to the value of his contribution to the totality of effort is thereby weakened, to his mental and moral detriment. And he who by the display of a kindly interest, whether real or simulated, in another's welfare obtains benefit from the effort of that other for which he does not make due recompense adds to theft the vice of hypocrisy. It is only under

the unhindered working of the law of supply and demand that exchange of effort can be made with ultimate justice to all, and this ultimate justice can only be attained when all persons whose efforts are interchanged clearly perceive the value of any particular effort, and willingly exchange effort for effort, benefit for benefit, in proportion to their true value. That increased morality which comes from increased intelligence alone will lead to this end.

And so also with charity. That there should be a distinction between helping those who can not work and contributing to the comfort of those who will not work, is being ever made more clear by those who have given studious attention to the ministration of charity. As to steal is to deprive others of benefit without yielding benefit in return, those who are physically and mentally able and have the opportunity to maintain themselves, but who abstract from others the benefit that conduces to that maintenance by the simulation of helplessness and appeal to sympathy, are no less than thieves. And, likewise, those who by appeal to sympathy obtain from others benefit in excess of that to which they are entitled under the unhindered working of the law of supply and demand, in common with those who because of sympathy extend that benefit, inflict a wrong upon society as a whole. Many persons of fine sensibilities, who live in comfort and are kindly disposed toward all men, feeling it their duty to alleviate pain, succor the distressed, and elevate the lowly, in the attempt to lift to a higher standard the life of those whose lot appeals to them in piteous contrast with their own, have scattered gifts and expended energy often misdirected because they have not recognized that the mold given by heredity and environment can not suddenly be changed, that true and lasting improvement to any one can only result from his own perception of and desire to reach a higher standard, and his own effort directed toward that end.

But, says one of the well-to-do, "Am I to be debarred from the exercise of kindness to my friends, to whom the giving of pleasure yields me manifold pleasure in return; am I not to have my good friend who lives more humbly than I at my house for dinner, for a drive in my carriage, or may I not take him with me for a journey that will give him needed rest and build up his health? Am I not to extend token of friendship by gifts to whom I choose?" The reply first and foremost is, that the highest end of friendship is removed far and above the exchange of material benefit. From the association of minds that are congenial and natures that accord, there is derived a rare and refined delight to which in proper bounds the exchange of kindness and gifts may minister; but it is polluted and broken the instant it becomes on either side a means for obtaining unrequited material gain.

Continuing the inquiry, he asks: "Is there no good to be accomplished by giving in charity? Am I to be prohibited from aiding the needy and giving succor to the distressed? Am I to use no endeavor toward bettering the lot of the more lowly than I?" The reply in part has been amply suggested. The highest charity to those who are able and have opportunity to work, but decline to do so, is to endeavor to make them clearly understand that unless they contribute as they are able to the benefit of others, there is no reason that from the efforts of others benefit should accrue to them. The highest charity to those who are able and willing to work, but have not the opportunity to do so, is to use every endeavor to establish conditions that will permit them to contribute as best they can to the benefit of others, and to receive benefit in full proportion to the value of their efforts in return; and, likewise, the highest charity to those who are susceptible to that training which would develop the capacity and willingness for contribution to the benefit of others, is to establish conditions whereunder they may receive that training. It should go without saying that those who are in affliction by reason of sickness, by the sudden death of those upon whom they have justly been dependent, or by reason of "plague, pestilence, or famine," should be given that succor which will restore or lead them to usefulness, and it should go without saying that, when it is just for one to give, it is just for the other to receive. And those who, from mental, moral, and physical defects, are actually incapable of maintaining themselves by their own exertions should be placed under conditions that will render them as little burdensome as possible to the community as a whole.

The foregoing are generalizations that bear upon the serious problems of the treatment of the criminal and shiftless, of labor, wages, and of education, and whose practical application under the existing status can not but often be most difficult. If, however, all who desire the betterment of their kind—all those who make and execute laws, who instruct their fellow-men in pulpit or press, who mold the minds of the young in school or home—would perceive as a principle that the greatest good to all comes from the contribution of each in kind and degree as may be possible to the totality of effort in return for benefit to the full value thereof, and would give that principle the fullest possible application in their own actions and in the endeavor to instill it in the minds of those under their guidance, or otherwise associated with them, all these problems, which are important factors in the great problem of civilization, will sooner or later, upon the basis of that principle, be solved.

It will be perceived that the full application of that principle will nullify many beliefs and traditions that, descending through

the centuries, still influence the mass of mankind. For example, the injunction of the Old Testament, "In the sweat of thy face shalt thou eat bread," which is reiterated from the pulpit as the decree of punishment that weighs as a burden upon mankind, fades in the perception of the grandeur of human effort; while a deeper significance comes to the injunction, "If any would not work neither should he eat"; and to the utterance, "Give every man according to his ways and according to the fruit of his doings." The fallacy that work is for hirelings, and the life of a gentleman a life of leisure, falls in the perception that no servitude is dishonorable, for from the maid in the kitchen to the statesman in the cabinet the efforts of all are in the service of mankind. The widely prevalent and not infrequently lauded practice in business circles, whereunder each party to every exchange endeavors to reap the entire benefit, will disappear. The man who ostentatiously disburses in so-called charity the fortune that he has amassed by sharp practice and overbearing greed will be unknown. When all people clearly perceive that they should receive benefit from all in proportion as they contribute to the benefit of all, the core will be reached of the dissatisfaction that breeds jealousy and distrust between the employer and employee, that leads to the grosser forms of socialism and anarchy; and when that perception is carried into practice the core will be removed. And not least, many of the accepted opinions in regard to the tenure of property acquired by inheritance will join the crumbled belief in the divine right of kings.

This essay, however, has not touched upon those actions whereby benefit is conferred by one upon another under the immediate relationship of family and marriage. The application of the principle to the elucidation of which it has been devoted can not but constantly be traversed by such actions, which comprise the begetting and rearing of children, the care by one for those who, under family ties, are justly dependent upon him, the transfer of property by marriage and inheritance. Did space permit it might be shown that in the last analysis all these actions, which are interwoven with all the other actions of mankind in the continuance and advancement of civilization, rest upon that principle also; that these, in common with all other actions, contribute to ultimate justice to all to the extent that that principle is recognized and given effect.

One of the most remarkable features of Albanian "full dress" is a petticoat reaching to the knee, made of white linen, sixty yards in width. The weight of the costume is very great; but the more yards in the garment, the greater dandy is the wearer.

RACE MIXTURE AND NATIONAL CHARACTER.

By LEWIS R. HARLEY, A.M.

THE term "nation" as used at the present time involves much confusion in thought; and an eminent writer, in order to fix clearly the meaning of this term in the mind of the student, has defined the nation as a population of an ethnic unity, inhabiting a territory of a geographic unity.* This high development of the nation has scarcely been reached in any part of the world, but as the geographic and ethnic elements tend to coincide, the national character grows stronger, and resolves itself into a political form called the state. In order to attain this high ideal, the territory must be separated by natural barriers, so that the national unity may not be disturbed by foreign influence, and in the development of ethnic unity there must be, first of all, a common language, so that men may understand each other and agree upon certain views. The introduction of the large number of foreigners into our country leads us to inquire whether there is such a thing as national character in the United States. Bancroft describes all the colonial traits as coming from the English or Anglo-Saxon. The Germans are often spoken of in the sense of being local, yet there is no better illustration of national unity than in the German empire. The English are often looked upon as being extremely practical, but the Puritan Commonwealth was ideal. It seems to have been an original principle in the political psychology of the Anglo-Saxons to evolve the national idea, and thus give to the world the strongest political organization, at the same time offering the widest range of liberty. It is generally admitted at present that there should be some restriction upon immigration. The influx of foreigners, being measurable by statistics, is wonderful. Since 1820 we have had statistics on immigration, which form a very important study. In the first decade, ending with 1830, there were 143,439 immigrants to the United States, while in the decade ending with 1890 the number had reached 5,246,613. In the census of 1850, statistics were for the first time obtained concerning the number of persons of foreign birth in the country. The proportion which each of these elements bore to the total population in 1850 was 90·32 per cent native born to 9·68 per cent foreign born, while in 1890 the proportion was 85·23 per cent native born to 14·77 per cent foreign born. Before 1820 immigration was trifling in amount, but in 1847 it set in upon a wonderful scale, and the famines in Ireland at that time led to a migration to this country which has been

* Burgess, Political Science and Constitutional Law, vol. i, pp. 1–4.

continued to the present day. The total immigration since 1820 amounts to 15,427,657, and of this number 40·42 per cent came from Great Britain and 29·20 per cent from Germany. Thus Great Britain and Germany have furnished 69·62 per cent of all the immigration to this country, while Norway and Sweden have supplied but six per cent. But the past decade furnishes statistics of special significance. Between 1881 and 1890 only 27·88 per cent came from Great Britain and 27·69 per cent from Germany. The immigration from Norway and Sweden has increased very much; while almost all the Hungarians, Italians, and Poles have come during the past decade. Indeed, it is said that in 1890 two thirds of the entire emigration movement of the world was directed toward the United States. The distribution of the foreign element is confined almost entirely to the Northern and Western States. In the North Atlantic division 22·34 per cent of the population is foreign born, the proportion ranging from 30·77 per cent in Rhode Island to 11·94 per cent in Maine. In the North Central division 18·16 per cent of the proportion is foreign born, the extremes being North Dakota with 44·58 per cent, and Indiana with 6·67 per cent. In the Western division the proportion of foreign born is 25·46 per cent, ranging between 32·61 per cent in Montana to 7·33 per cent in New Mexico. The South Atlantic division has been affected but very little by immigration, only 2·35 per cent being foreign born. Of this group of States, Maryland has the largest proportion, 9·05 per cent, and North Carolina the smallest, with 0·23 per cent. In the South Central division the foreign element is also very slight, being only 2·93 per cent, the greatest proportion being in Texas, where it is 6·84 per cent, and the least in Mississippi, 0·62 per cent. A study of the eleventh census shows that the States which a generation ago attracted foreigners still attract them in almost the same degree. Immigration was thus turned to the North and West by economic and climatic conditions. On account of the slave system in the South, there was no inducement for immigrants to locate there; thus the ideas of this section were never modified by foreign influence; again, the Germans and other immigrants from the northern part of Europe were attracted to the Northwest on account of the climate. Accordingly, the movement of population was westward along the parallels. The institutions of the South remained unmodified by the influx of foreigners, and the sections became more and more estranged, making the civil war possible.

Another element which enters into the problem is the proportions in which the total white population is made up of native whites of native parents and of whites of foreign parentage. This is of great importance, as it presents the distribution of the native and foreign blood throughout the country. In Massa-

chusetts 56·87 per cent of the population have one or both parents foreign born; Rhode Island, 59·29 per cent; New York, 57·45 per cent; Maryland, 30·27 per cent; Wisconsin, 74·14 per cent; Minnesota, 76·01 per cent; North Dakota, 79·74 per cent; Louisiana, 26·02 per cent; Utah, 66·75 per cent. We notice again that the white element of foreign extraction is found chiefly in the Northern and Western States. The native whites having both parents foreign should also be considered. The proportion of this element varies as follows: Massachusetts, 27·09 per cent; Rhode Island, 27·29 per cent; New York, 30·64 per cent; Maryland, 15·01 per cent; Wisconsin, 43·09 per cent; Minnesota, 39·80 per cent; Utah, 41·04 per cent. The Southern States show the usual small percentage, ranging as follows: Virginia, 1·52 per cent; Georgia, 1·07 per cent; Mississippi, 1·30 per cent; while, taking the Southern and South Central sections together, the proportion is only 4·13 per cent.

The colored element in 1890 amounted to 7,470,040, the population being distributed as follows:

North Atlantic division	1·55 per cent;
South Atlantic division	36·83 " "
North Central division	1·93 " "
South Central division	31·71 " "
Western division	·89 " "

In taking the South as a whole there was a proportional increase in the colored population up to 1840, but since then the proportion has diminished gradually. Having stated the principal elements with which we have to deal, let us now consider the various methods of dealing with the problem.

If we consider the problem from an ethnological standpoint, we shall have four races in the United States—the white, negro, Indian, and Chinese. But these races do not mingle together. The Indian is dying out, and, although the negroes mingled in the days of slavery, the offspring carried the stigma of the race. Herbert Spencer is the chief authority on the sociological theory of the mixture of races. He claims that it is a theory of evolution, and the unity that is developed is not of blood but of institutions. The historical theory does not try to determine whether there is really a mixture of blood, but it simply considers the institutions, customs, and laws, and how these have been modified. In applying this theory to the United States, the mixture of races does not mean a mixture of blood but of institutions.

The mixture of nationalities in this country has differed from that of other parts of the world. In other countries mixture has occurred by conquest, but it has been peaceful in the United States. There has been no forcing of institutions or blood, except in the case of the negro, and we thus have the unique negro

problem whose solution no one can predict. The immigrants did not come here in tribes, but as individuals. If the millions of Germans had come with state encouragement in a body, the results might have been different, but they came as individuals and mingled with our people.

I have already stated the elements that are to be assimilated. For the purpose of convenience, they may be classed into four groups as follows: 1. Colored, 7,000,000, or twelve per cent. 2. Native whites of native parents, 34,000,000, or fifty-five per cent. 3. Native whites of foreign parents, 11,000,000, or eighteen per cent. 4. Foreign born, 9,000,000, or fifteen per cent.

These elements differ by blood, by parentage, and by birthplace, and they are of great importance. No other country has such important elements, and no nation has ever sought to solve such a question in a peaceful way. The native American is the element about which all others must be grouped, and they must be assimilated to this. The third element is very interesting. This class stands halfway between the foreign and the native. It represents the process of assimilation in the act. The fourth element is the foreign born, and it is the most difficult to assimilate on account of its constant renewal.

There are two ways of combining these figures. The third and fourth elements may be added together, and we will then have 20,000,000. These figures show how large the foreign element is. In regard to its distribution in New England and the Northwest, New England would have forty-seven per cent foreign population; in Massachusetts alone this element constitutes fifty-six per cent; in Rhode Island, fifty-eight per cent; in New York, eighty two per cent; in Wisconsin, ninety per cent. But it is not right to consider the second generation as foreigners. They are more American than foreign. It is best to contrast these two classes and measure their relative strength. We find in the East that the first generation outnumbers the second, while in the West the second generation is the stronger. Thus the question of foreign influence is a more serious one in New England than in the Western States.

The chief forces tending toward the assimilation of races in our country are physical environment and social environment. The physical environment means not only the influence of Nature, but also the habits of life. In this respect the influence of frontier life should be considered. From the beginning, the people along the frontier have had a struggle with Nature, and they developed self-reliance and the capacity for self-government. So the pioneer set up self-government in the wilderness, and the State Constitutions of the West and Northwest, where the proportion of immigration is so great, show no signs of foreign influ-

ence, but they all contain the fundamental ideas of American liberty. This influence of physical environment still goes on, and in subduing the wilderness the pioneer abandons the habits of the Old World and takes up those of the New. Thus the continent forced the conditions of its conquest.

Herbert Spencer, in his Principles of Sociology, states that the earlier development was at the mercy of the physical environment, while civilized man has reduced Nature to subjection. As society progresses, new factors come in to modify the physical organization, which Spencer calls the super-environment or social environment. Spencer claims that the social environment is more powerful than the physical environment. The men who settled this country had a social history behind them, and the institutions that they brought here greatly influenced their children. What I said in regard to the physical environment may also be said of the social environmeut. The immigrants did not come in bands, but individually, and the social environment had full play. During the colonial period the immigrants were chiefly English, and the English stamp was upon the institutions which they planted here. So it has not been a mingling of institutions, but foreigners have assimilated the institutions already established here.

One of the chief influences of the social environment is education. This is very important, as so many ignorant come. It is important to know how receptive these people are to our institutions. This will depend upon their power to learn our language, and upon the standard of intelligence of the native country. Out of the 15,000,000 foreigners who landed here between 1820 and 1850, forty per cent came from English countries. This proportion is growing less, as in 1891 only twenty-two per cent came from English countries, while from all German countries the proportion is thirty-one per cent. A new difficulty may arise here, in that people of other languages may now find communities where their own language is spoken; but this can hardly be urged as an objection, for, in the case of the German immigrants, they come from a country with a high standard of education. We depend upon our school system to reach the immigrants and prepare them for citizenship. The parents can not be reached by the schools directly, so the system must exert its influence upon the children of the immigrants. The eleventh census shows that the foreign-born element of school age between five and seventeen years is 900,000. The second generation, or native born of foreign parents, is 12,400,000, and the number of immigrants foreign born above seventeen years is 8,332,000. This shows that the problem is very favorable, as, for every hundred who can not come under the influence of our schools, there are one hundred

and fifty who can. In the Eastern States the second generation is less numerous than in the West. The influence of our schools is apparent, for, if we take Massachusetts as an example, we find that of the native-born population one per cent are illiterate, while of the foreign born twenty per cent are illiterate.

Another influence of the social environment is the exercise of political rights. Here the second generation can not be looked upon as foreigners, as all persons born or naturalized in the United States are citizens thereof. The terms of naturalization are such that the foreign born may become citizens in five years. Whatever may be the dangers of foreign influence upon our government, surely one of the best methods of assimilating the discordant elements is to make all classes feel that they have an interest in our institutions, by the exercise of political rights. If this process of assimilation had not been going on, we should be able to notice some effect upon legislation in the different States. Assimilation is promoted by the participation in the holding of property. Thousands of foreigners have availed themselves of the land grants by the homestead and other laws. Having vested interests, they are loyal to the Government, for very few property-holders become anarchists. Self-reliance and independence also tend to attach the foreigner to our institutions. Our system is not paternal in its character, but the guarantees of civil liberty are so broad that they offer the greatest measure of individual action. Every man's house is his castle, and some writer has said that, although the snow and rain may blow in, the king can not enter. The prominence given to labor in America is also conducive to the assimilation of the foreign elements. A new dignity has been placed upon labor here, and we are passing over from a political to an economic attitude, which will have its effect upon all classes. Titles and rank, which have done so much in the Old World to keep the classes alienated, are unknown here, and their absence is the means of encouraging foreigners to accept the responsibilities of citizenship. Economic influences which have frequently been overlooked, are also a potent factor in the assimilation of races. I have already referred to the dignity of labor in this country. The laborer is not regarded as depending upon a wage fund for support, but he is looked upon as an integral part of society, receiving a share in distribution. There are causes at work affecting consumption, and society is in a dynamic state. Changes in the economic order of consumption are taking place which tend to raise the standard of life. Economic conditions induce the foreigner to leave his native land and come to America. On arriving here, he is probably influenced as much by the standard of life of our people as by any other cause. He enters the field of labor and attempts to reach our standard of

life, and in doing so he must abandon his old habits of life and adopt those of our country. Thus, through labor an assimilation takes place. This has been the process in our Northern and Western States, which have received that great bulk of immigration during the century.

WOMAN AS AN INVENTOR AND MANUFACTURER.*

THE question has been seriously raised whether woman is capable of important achievements as an inventor, and an opinion actually exists and is held in good faith by some otherwise intelligent persons that she is not. The Patent-Office records have been searched to show that woman's modern work in inventive art has been insignificant; and occasionally, when some woman's invention is announced, it is treated as something unusual and very remarkable. A perusal of Dr. O. T. Mason's narrative of Woman's Share in Primitive Culture should convince the unprejudiced reader that this is a most shallow view to take of the matter. In that book she is shown to be the earliest inventor, and is proved in numberless cases to be the author from the most ancient times of the most important inventions and those which have contributed most to human well-being.

From the primitive age when the division of duties was first made between man and woman (somewhat roughly drawn, it is true, as the rudeness of the then existing conditions compelled) but substantially along the lines it has followed among all peoples who labor, woman's ingenuity has been an important element of progress. As the food-bringer, which is the character under which Dr. Mason first presents her, "to feed the flock under her immediate care, woman had to become an inventor, and it is in this activity of her mind that she is specially interesting here. The hen scratches for her chicks all day long because Nature has furnished her hoes and rakes and cutting apparatus upon her body. But here stands a creature on the edge of time who had to create the implements of such industry." In the search for food materials she first appears as taking fruits and other parts of plants that are ready for consumption without further preparation. Next she took a stick and carrying basket and sought out roots and other parts that might be prepared by roasting or perhaps by boiling with hot stones. "On her third journey she gathered seeds of all kinds, but especially the seeds of grasses, which at

* Woman's Share in Primitive Culture. By Otis Tufton Mason. Anthropological Series, No. 1. New York: D. Appleton & Co., 1894.

her hand were to undergo a multitude of transformations. These had to be broken up or ground, and called for the devising of grinding apparatus. Wherever the tribes went in the early days women found out by and by the great staple productions that

FIG. 1.—THE BASKET-MAKER—CALIFORNIA WOMAN AT WORK. (After Henshaw.)

were to be their chief reliance; and "the whole industrial life of woman is built up around these staples. From the first journey on foot to procure the raw materials until the food is served and

eaten there is a line of trades that are continuous and that are born of the environment."

The five sources of information respecting primitive woman's activities are found in history, which records the things of pristine culture that lingered three or four thousand years ago; language, which has crystallized expressions descriptive of early conditions; archæology, which recovers the things they did before there was any history; folklore, a perpetual record of the most ancient occupations and customs; and living tribes that have stood still during all the ages.

FIG. 2.—THE PRIMITIVE LOOM WEAVER —NAVAJO WOMAN, ARIZONA. (After Matthews.)

The variety of occupations in which primitive woman displays her genius is illustrated in a description quoted from Im Thurn of the day's work of a Carib woman in British Guiana, in which she is seen performing the parts of a "mother, butcher, cook, beast of burden, fire maker and tender, miller, stonecutter (stone-griddle maker), most delicate and ingenious weaver, engineer (devising a mechanical press and sieve in one woven bag and using a lever of the third kind), baker, and preserver of food. Add to this her function of brewer, and you have no mean collection of primitive industries performed by one little body, all of which underlie occupations which in our day involve the outlay of millions of dollars and the co-operation of thousands of men."

FIG. 3.—ESKIMO "SCRAPER," MADE TO FIT THE WOMAN'S HAND. (After Mason.)

"Suppose a certain kind of raw material to abound in any area or country; you may be sure that savage women searched it out and developed it in their crude way. Furthermore, the peculiar qualities and idiosyncrasies of each substance suggest and de-

mand a certain treatment. Women of the lowest grades of culture have not been slow in discovering this; so that between them and the natural product there has been a kind of understanding or co-operation leading to local styles. If these women were moved far away, they carried oftentimes these processes with them and plied their old trade upon such strange materials as they discovered in the new home." So negro women brought basket-making from Africa to America and taught it to the Indians.

Subsidiary to the weaving and basket-making practiced by women in savagery are spinning, netting, looping, braiding, sewing, and embroidery. Bark-cloth weaving is practiced by women in the tropics all round the world. "Each and all of these require tools which the workwomen must fashion for themselves. And, though the earth had the raw materials in abundance, it did not yield them without a search which would do honor to the manufacturers of our day. . . . Aboriginal woman's basketry excites the admiration of all lovers of fine work. It is difficult to say which receives the most praise — the forms, the coloring, the patterns, or the delicacy of manipulation. Primarily, her basketry divides itself into two sorts of types—the *woven* and the *sewed*, the former built up on a warp, the latter produced by the continuous stitching of a coil. Of these two main classes there are many subclasses, which have been necessitated by the nature of the material which the fabricator has at her hands, and by the uses to which the products have to be put."

FIG. 4.—ESKIMO FAT SCRAPER OF REINDEER ANTLER AND RAWHIDE. (After Mason.)

Weaving is the climax of the textile industry; and "among all the types of modern savagery—American, negroid, and Malayo-Polynesian—intricate processes of weaving were in vogue before they were approached by the white race." In comparison with the complex and world-embracing activity of modern weaving and commerce, "how simple the process in savagery! The women there go to the fields or to the animals for the fiber, or hair, or wool. They transport the material on their backs, in carrying

frames and apparatus that they themselves have made, and prepare it . . . to be woven, or sewed, or embroidered. They make up the bag, or mat, or garment, or sail of a whole piece, and wear it out in use, the same woman in each case following the material from the cradle to the grave." The subsidiary textile arts are of much importance in savagery, and they are of great antiquity, remains having been found in very old deposits.

In her tanning and skin-dressing work the savage woman's problem was to remove the dermis from the hide, and leave the hair adhering to the epidermis, with only a thin portion of the true skin. If the work were creditably done, the surface of the robe, "frequently more than thirty square feet in extent, had to be uniform in thickness throughout, and she should not cut through

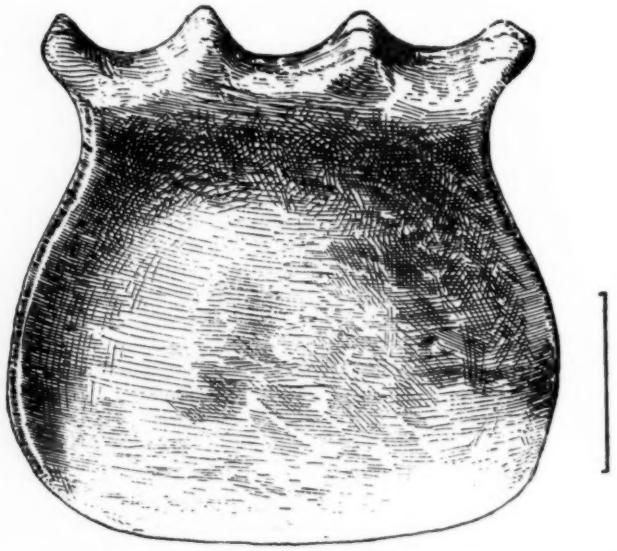

FIG. 5.—ESKIMO FAT SCRAPER OF WALRUS IVORY, MADE TO FIT THE FINGERS. (After Mason.)

the epidermis once. The whole must be as pliable, too, as a woolen blanket: the problem was to reduce a hide of varying thickness and twice too thick everywhere to a robe of uniform thickness throughout without once cutting through the outer part of the skin. Her tools for this varied with the locality. The Eskimo women scrape off the fat with a special tool made of walrus ivory or bone and plane down the dermis with a stone scraper. The Indian women cut off bits of meat and fat and remove the dermis with a hoe or adze. In the good old days of savagery the Eskimo woman made her fat scraper of walrus ivory or antler; her skin scraper was of flinty stone set in a handle of ivory, wood, or horn, whichever material was easiest to procure. But later on, it may

be, the whalers helped her with steel tools. The Indian woman had three tools—to wit: the stone knife for cutting away the flesh; the hoe-shaped scraper for splitting the skin; and the grainer, a hoe or chisel-like tool with serrated edge to roughen up the inner side of the robe and give it flexibility. Besides these, both Eskimo and Indian had hands and feet and teeth for pulling and pounding and breaking the grain. They had also a wonderful supply of pride in their work, and love of applause, which kept them up to the mark of doing the best that could be done with their resources." The scraper is the oldest instrument of any craft in the world. The Indian women of Montana still receive their trade from their mothers, and they, in turn, were taught by theirs in unbroken succession since the birth of the human species. With the scraper the hair was removed, when that was desired, after having been loosened by exposure to chemical treatment with quicklime, or by a process of fermentation. The methods of preparation corresponded with the purposes to which the skin was to be applied, and these were various. "The tailoring of savage women, especially that of the North American women, is most interesting. While the weavers in the south were making blankets and *serapes* in the whole piece, never cutting their goods, the tailors north of the Mexican border were excellent cutters. For scissors they used the woman's knife, called *ula* by the Eskimos, a blade of chert or other rock, crescent-

FIG. 6.—MAKING COILED WARE IN BASKET BOWL. (After Cushing.)

FIG. 7.—BASKET BOWL AS BASE MOLD FOR LARGE VESSEL, SHOWING ALSO THE SMOOTHING PROCESS AFTER COILING. (After Cushing.)

shaped on the outer edge, and a most excellent device for cutting skin without marring the hair. Scissors would be useless in this connection, for they would shear the hair as well as the hide and make an ugly seam. In the fitting of garments these primitive tailors anticipated the long list of terms, such as puckering, gathering, inserting gores, and the like. For tucks in their more beautiful dresses they inserted band after band of the skins of different animals, bits from different parts of the same hide, and strips of bare hide ornamented by quill-work. Tufts of feathers or long hair, pendants of shell, hoof, teeth, or bone —in short, all objects of comely shape and pretty color and proper size—were gathered into the costumes of men and children as well as into their own." The reticule, the tobacco bag, the traveling case, the bandbox, and the packing trunk all exist among savages, and in North America were made by women, chiefly from the hides of animals.

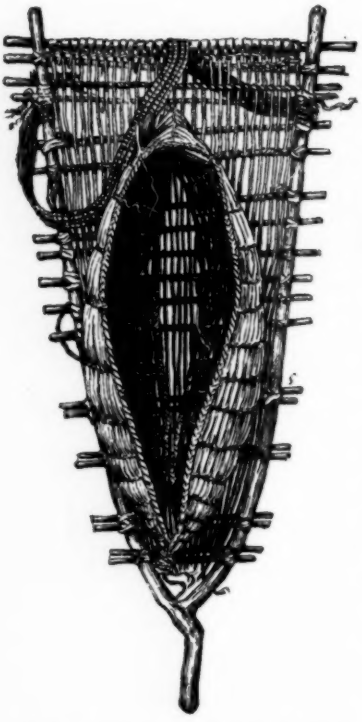

FIG. 8.—CALIFORNIA CRADLE FRAME. (After Mason.)

The potter's art may be seen in its pristine simplicity in the soapstone or earthen lamp and stove of the Eskimo, and in the arid regions of New Mexico and Arizona, as well as in South America, Africa, and New Guinea; and it is woman that carries it on. "In the Southwestern States of our Union women have, from time immemorial, practiced the art of pottery with the greatest success. There is no reason to believe that their present methods and tools and products are different at all from what they were a thousand years ago. . . . The women go forth to the *mesa*, where the proper layers of clay are exposed, and quarry the raw material. To do this, one would say they ought to be good mineralogists and skillful engineers. They also gather from the sediment of the streams most excellent clay for their paste." If the potter-woman does not find this excellent paste, she gathers and carries home on her back the clay quarried from the *mesa;* and in doing this she becomes a pack-woman. She washes the clay, lets the gravel and worthless material sink or float, decants the liquid, and allows the fine aluminous earth to

settle. "Though the term 'specific gravity' was unknown to her, she seems to have seized upon this principle in order to gather out the elements desired. This fine paste will not make pottery; it will crack badly in drying and baking. But our ceramic worker is equal to the occasion, and long ago had discovered, as every archæologist knows, that sand or some other tempering material must be added. The oldest fragments yet discovered reveal in their texture grains of sand, put there by Nature or by the potter, bits of pulverized shells, or the remains of old pots ground fine and worked over into new vessels." She sorts material for coarser and for finer ware, turns it with her hand, guided by her eye, molds it around or within some object to give it shape, using gourds, nets, or baskets for the purpose, whose forms and peculiar markings are thus preserved, and arrives at the stage of

FIG. 9.—ESKIMO MOTHERS. (After Healy.)

making pottery like basketry, for which she rolls out a slender cylinder of prepared paste, and builds her vessel by coiling this cylinder around the form. The evolution of form in this Pueblo ware, by which a flat disk becomes a bowl, and from that are derived various forms of bottles and vases, has been well studied by Mr. Frank Cushing.

"From woman's back to the car and the stately ship" is the

history of the carrier's art; and woman "was primarily the only creature that transformed Nature to produce an apparatus for the carrying of burdens. . . . Many other industries were created, stimulated, and modified by this carrying trade. The member of pristine society who went to the fields to gather nuts and seeds and fruit must necessarily have brought them home. Hence the burden-bearer must be a basket-maker, and the pack-woman is a patron of husbandry and of the textile art. Clay and fuel must be brought to make pottery, and pottery, in turn, has to be shaped to carry water and food; so the potter and the carrier are sisters. It can not fail to be interesting to know how ingeniously these early passenger cars were constructed." The builders were strictly scientific in their methods, in that they ingeniously adapted structure to function and environment. To the Eskimo mother the great consideration is to protect the child from the cold. "So she makes a baby carriage of her hood, and her offspring, when she takes it abroad or when she is on a journey, is safely ensconced between the soft fur and the mother's warm neck. All the American tribes used a papoose frame of some sort." The distinguishing marks of this apparatus were the back, the sides, the lashing, the bed, the pillow, the covering, the awning, the decoration. All these were present in some form, but in each stock, and especially in each natural-history region, there were just such variations as were necessary and proper. In Canada the cradle was made of birch bark and the bed was of the finest fur. In the coast region of British Columbia and southward little arklike troughs were excavated as the boats were, and beds and pillows and wrappings of the finest shredded cedar bark took the place of furs. Farther south still, as the climate became milder, the ark gave place to a little rack or gridiron of osier, sumac, or reed, and the face of the child was shaded from the sun by a delicate awning. Across the Rocky Mountains, in the land of the buffalo, the papoose frame looks like a great shoe lashed to an inverted trellis or ladder, and nowadays the whole surface is covered with embroidered beadwork. It matters not where we travel within the limits assigned

FIG. 10.—THE KNAPSACK IN WOMAN'S WORK—GERMAN PEASANT WOMAN.

on the western continent, the primitive passenger car was exactly suited to the meteorological and other conditions." This is one class of devices that women have contrived for carrying precious

FIG. 11.—FLORENTINE WOOD GATHERERS. (After Gioli.)

burdens. They are also in all savage lands, and in some civilized, the bearers of loads of a more common and grosser sort, and for these they have invented a variety of appliances, adapted to dif-

ferent positions and different kinds of loads: cushions for placing the burden on the head; cords or straps for supporting it from the head while it is carried on the shoulder or the back. "Away down in Arizona hay is delivered at the agency by Mojave Indian women, who go out and cut with common house knives the 'grama grass,' put it up in immense sheaves, and bring it to the agency on their backs," or rather shoulders, a sheaf of hay sticking from each end of a pole that rests on the shoulders, and knapsack contrivances of different kinds. We generally suppose that the knapsack belongs to soldiers and schoolboys; but "if you will get up early some morning and walk around the busy portions of a German city, you will see upon a box or table a cylindrical basket, holding half a bushel, more or less, with the sticks of the frame projecting an inch or two downward from the bottom, and two broad straps fastened at one end to the rim of the basket and having eyelets or loops at the loose ends. Presently you will see a woman back up to the basket, draw the straps over her shoulders, and pass the ends backward around the projecting frame sticks below. She is now hitched up and may walk off with such load as the basket may contain. Perhaps this is older than the knapsack." Women are carriers, too, in France, and a picture by Gioli, exhibited at Venice in 1887, shows that in Italy, also, that work has not been taken off from her.

"It is not enough, in speaking of savage women, to say that they, as a class, do this or that. It should also be asked how many of these are performed by one woman—in short, by every woman. Recalling what was previously said about the user of an implement having to be the maker of it, one sees to what a diversity of occupations this would naturally lead. . . . It is not enough to say in any case, as we have seen, that she was food-bringer, weaver, skin-dresser, potter, or beast of burden. This view of her is absolutely misleading. It is not sufficient to say that the modern lucrative employments originated with her. We are bound to keep in mind that each woman was all of these. As in the animal world one part of the body performs many functions, in the social world one woman is mistress of many cares. The diversification of duties in well-regulated houses among the civilized nations produces the matron. The savage woman is really the ancestress and prototype of the modern housewife, and not of our factory specialists."

Savage woman next appears on the scene as an artist; and her originality and skill in this line are illustrated in every piece of pottery and every basket; in decorative work of all kinds, and in costumes in a thousand designs of form and color, all of which the maker had to invent, and furthermore to find means and instruments for producing them.

In the aspects of a linguist, the founder of society, and the patron of religion, in all of which Mr. Mason exhibits woman as a leader, we have not space to follow him. We therefore leave her here, as the founder of some of our most useful material arts.

MICROBES AS FACTORS IN SOCIETY.*

By M. L. CAPITAN.

IN an address delivered before the Anthropological Society of Paris, July 2, 1867, Paul Broca very neatly emphasized the fact that the population of a country can not increase indefinitely. As the population multiplies on a territory that is extensible, the more undesirable lands are gradually improved and occupied. The holdings are made smaller, woods are cleared, barren tracts are fertilized, and marshes are drained. Till these works are completed all goes well, but the time comes at last when every place is occupied. The resource remains of emigration to unsettled countries. Our planet, however, is not elastic; when all of it is occupied and bears all the population it can sustain, what will then become of the human race? The balance of population and resources is kept up by death, which cuts down the living and leaves the places they filled to the newborn.

Dead beings, too, must be got out of the way. Even in that condition they claim too much space. They, moreover, fix an important quantity of matter—that of which their tissues are constituted. Matter, we all know, is not infinite in amount; it is undergoing incessant transformations, and is never created. It is therefore necessary that dead organic matter, which is essentially insoluble, be disaggregated, dissociated, and dissolved, to be fixed again by new beings. This is accomplished through the intervention of the phenomenon of decomposition or putrefaction. Putrefaction, Pasteur has demonstrated, is the function of microbes. Without them the disaggregation of matter which would probably be produced by solar radiations would be absolutely insufficient; consequently matter would accumulate in continually multiplying and insufficiently dissociated organic combinations. Without microbes, therefore, life would not be able, for lack of available matter, to continue on the globe. Applying these data to the accumulations of human beings which make up societies, we find that they are rigorously exact. We have, then, in this reduction of fixed matter to conditions under which it can be

* An address (*Conférence Broca*) delivered December 14, 1893, before the Anthropological Society of Paris.

assimilated, the first and a considerable function which microbes perform in society.

Microbes have other equally important and useful offices. Of these is their action in digestion. Ordinary digestion is performed in the stomach and the intestine by means of soluble ferments secreted by the organic cells, which attack alimentary substances, dissociate them, and render them assimilable; and this is perceived to be a function very similar to that of microbes. The digestive passages, however, contain immense quantities of microbes continually brought in with the food, multiplying infinitely, and performing exceedingly complex offices. Even if we take up only a few of these offices, we are compelled of necessity to assume that they intervene in digestive operations, either as aids to the organic diastases or as themselves effective agents. M. Duclaux, insisting on this point, has remarked that some celluloses are capable of being attacked only by microbes, no organic juice having sufficient strength to affect them. M. Pasteur does not believe in the possibility of digestion in a medium completely deprived of microbes.

Of the chemical activity of microbes, what we know is as nothing in comparison with what it may be. Every species, every race, every variety of microbe is charged with a special function; the division of labor is carried among them to its extreme limits, so much so that in any chemical reaction each microbe takes its part in producing the process at different stages. Each variety has its duty in the work, determines a partial dissociation of the material which another species completes, and so on to the extreme simplification of organic matter, reduced to its elementary constituents, or to such conditions as to be assimilable by the plant.

These chemical actions determined by the microbe are therefore infinite and infinitely varied. Take two examples among a thousand. Starting with a single body—sugar, for example—the microbes may transform it into dextrolactic or serolactic acid or an indifferent acid, according to their own activity, the culture medium, or the associated reactions. Reducing agents in a high degree, microbes transform sulphates into sulphites, and even into sulphurets, the latter yielding, still by means of microbic reactions, sulphohydric acid. Thus, by this mechanism of successive dislocations, microbes, starting from sulphates, end by producing sulphurous water. This simple enunciation of a very special microbic process illustrates the extreme complexity of the chemical function of microbes, which are furthermore often aided in their work by solar radiation, likewise a powerful chemical agent, the action of which, though less immense than that of microbes, is similar to it. As a chemist, the sun proceeds like a microbe—a

strange and remarkable similarity of action, mentioned by Claude Bernard in his last notes, and now demonstrated by M. Duclaux and his pupils. The climax of these complex chemical reactions is reached in the *humus*, which is compared by M. Duclaux to a laboratory in ceaseless activity, into which the primary matter is continuously entering to be worked up there and transformed into new products assimilable by the plant.

Availing itself of the action of an external force, the solar light and heat, this laboratory employs as its workmen the microbes, which only are capable of carrying the complicated task to a good result. Fixers of nitrogen, for example, in the nodular formations of the leguminous plants, preparers of nitrates, and constantly producing soluble organic substances at the expense of insoluble matters, the microbes work untiringly in this vast abode of chemical transformations.

Yet more: as old as the living world, contemporaries of the earliest generations of plants, microbes have contributed in a powerful way to the constitution and formation of the geological strata. Peat, which later becomes coal, has been formed by the action of microbes; they have been the agents in the complex processes of precipitation by which the immense masses of various limestones have been formed; they have played a part in other reactions from which deposits of iron, sulphur, and most of the metals have resulted. This enumeration might be very much extended. These innumerable and strong chemical actions, ancient as some of them are, still play an immense part, which is absolutely necessary to the existence of the social medium. From the point of view solely of producer of coal and preparer of iron, the microbe justifies its claim to be an agent indispensable to the life of all society. But its function is still more complex and extended.

The chemical work of microbes is often used industrially by man. Two examples in which this is done may be taken as typical. Indigo is extracted from a plant which is cultivated chiefly in India, Japan, and Central America. The plant contains a sugar, indiglucin, which is separated by washing in warm water, and is then subjected to a special fermentation. The microbe splits it into indigotin and glucose. The indigotin, which is colorless, is oxidized, still by means of a microbian reaction, and is transformed into blue indigo. This preparation would be impossible without these special microbian reactions.

Another example of the chemical activity of microbes is furnished in the preparation of opium for smoking. The juice of the poppy, from which opium is derived, was till lately fermented in tubs to give it the desired qualities. Recently M. Calmette, of Saigon, discovered that this transformation was due to the *Asper-*

gillus, a fungus allied to the microbes. Since then it has been enough to sow the tubs in which the fermentation proceeded with the pure *Aspergillus* to obtain a better return and an opium of superior quality in only one or two months.

In the preparation of several most indispensable alimentary products certain micro-organisms, domesticated as it were, prove themselves incomparable chemists. Without them these preparations would be impossible. Among such products are bread, alcohol, wine, beer, and such fermented substances as koumiss, cheese, and sauerkraut.

These microbes are inferior algæ formed of one cell, usually with an envelope. They live almost everywhere on and with living beings, in the ground, in water, on solids, etc., and multiply with extreme rapidity. They produce a great variety of actions, some of which, as we have seen, are beneficial, while others are injurious.

As microbes decompose dead matter, so they are capable of disorganizing living matter. Some species have this power in a marked degree, which is distinguished as virulence. They are called pathogenic microbes, which means capable of causing illness. Each species of pathogenic microbe produces a particular kind of disease, and has a power that varies considerably according to a number of circumstances. The microbe alone, however, can not produce disease: that requires the intervention of the organism of the subject in which the disorder is to be developed. The disease is, in fact, the resultant of the reaction of the one upon the other of the two factors, the microbe and the organism. According to the felicitous comparison of Prof. Bouchard, the organism is a strong place, the microbe is its assailant, and the struggle between them is the infectious disease. The condition of the organic estate which the microbe endeavors to seize is therefore important. If the person is in general good health, he will offer a vigorous resistance to the microbes. If, on the other hand, his health is not perfect, there will be a point where the defenses are weak, and his danger will be proportionately great; for, as M. Bouchard said some time ago, one does not become ill till he is already not in good health. There are many ways of getting into poor health. It may be done by a number of processes, which may be summarized under the two categories of troubles of the organic functions or lesions of the tissues. Some of these pathogenic processes depend directly on a variety of social influences.

Wealth and poverty are alike efficient factors of disease. The rich man, by his often superabundant diet, his neglect of exercise, and his excess of luxury, readily contracts obesity, gout, or diabetes; his kidneys and his heart are frequently afflicted with dis-

order. The poor man, by different forms of inanition, overwork, exposure, or uncleanliness, is liable to derangements of the lungs, liver, kidneys, bowels, etc. Like the rich man, he has a pathology special to certain organs, and different from that of the other, but which is due to his social sanitary situation.

The professions also entail their special maladies, which are liable to infect those who exercise them. Lead chemically poisons those who handle it—painters, printers, white-lead makers, etc.—and mercury is dangerous to silverers of glass and gilders; while each poison affects particular organs most directly—lead the kidneys, bowels, and brain, mercury the brain and nerves. Examples might be multiplied to show how the profession may injure the organs, create real diseases, or induce an imperfect condition of health which will facilitate the invasion of the microbe. It is not necessary to dwell here on the pathogenic effects of alcoholic intoxication—a condition which is in every feature the product of social influences. It ravages all classes of society, and is illustrated in the most various pathological modalities.

In short, we find that a great multiplicity of mechanisms, all of social origin, may affect the internal organs in their structure or their work, and bring the person into a condition of receptivity to microbes. A thousand social conditions may expose us to the invasion of microbes and thus make real the second term required to constitute an infectious disease. The hostile microbe is in fact everywhere—within and without us, seeking, we might say, what it may devour. All the natural cavities of the body—the nose, the mouth, and the digestive tube—having exterior openings are seeded with microbes brought from without by air or food, and afterward multiplied. The skin is similarly exposed. Among these microbes there are also others, the relics of infectious diseases, with which the subject, now well, has been formerly attacked. All these microbes live in the normal condition of a later life; they are sometimes useful, as we have seen in regard to digestion; more frequently inoffensive in the face of the resistance opposed to them by the cellular coverings of the organic cavities or by the activity of those zealous defenders of the organism, the white globules, or by the chemical action of the organic liquids. But when the texture of these coverings is modified by some of a variety of circumstances, whether of external or of internal origin, or when one or more of the microbes attain an unusual degree of virulence, then the protective barriers will be overcome, the microbe will penetrate to the interior of the tissues, and will be able to bring on some of a great variety of diseases, from pneumonia to erysipelas, meningitis, or liver disease.

The microbes living without the organism are likewise of

various origin. We have already mentioned the innumerable varieties living in the ground, in the water, and on plants, which play so many important parts. Some of them may, under many circumstances, borrow a pathogenic power and produce diseases. There are also others, normally pathogenic, which have been eliminated from diseased organisms, and instead of succumbing at once they have fallen into the outer world, have adapted themselves to the new medium, and are living another life in the ground or in water. They are all ready when, with food or by respiration, or by a scratch of the tissues, they enter a living organism anew, to determine in it, if circumstances are favorable, the disease characteristic of them. So do the microbes of cholera, tetanus, etc. Social influences play an important part also from this point of view. All kinds of microbes may be carried to long distances by the solid matters of every kind that are employed in innumerable ways in the life of society. The solids may transport the microbes just mentioned as living in the external medium, and also those which come direct from a diseased subject. This distribution of agents of infection by solids is of extreme importance, but has attracted attention only within a few years. The hands may retain infectious germs and carry them to a long distance, often without the person carrying them being affected. Examples are abundant that illustrate the transportation and propagation in this way of pyogenic and septic infections, erysipelas, etc. Clothing, carriage cushions, tapestries, and bedding may preserve and carry cholera, smallpox, scarlatina, diphtheria, and erysipelas. The most various utensils, food, and particularly bread, may be soiled by pathogenic microbes, and thus facilitate their penetration into the organism.

We may understand, therefore, without having to insist upon it, how a large number of social circumstances may expose persons who live in society to the attacks of microbes. One's occupation will often force a person to come into contact with patients afflicted with infectious disorders, or with excreta from such patients containing pathogenic microbes, and thus cause him to contract such diseases as cholera or typhoid fever. Occupations having to do with diseased animals may also expose those who are engaged in them to direct infections, as when a groom takes care of a glandered horse; or to indirect infections, as with tanners preparing the hides of animals that had anthrax.

These examples show that there are extremely multiplied processes that may expose men living in society directly to infection by microbes, while mechanisms not less complex and equally of social origin may prepare the organic ground for the invasion of the microbe by changing either the structure or the working of the organism.

To these special causes of infectious disorders—invasion by microbes and their intra-organic evolution—hygiene is able to oppose a number of means of protection or defense; this is the part of prophylaxis. The physician can, besides, assist the organism to make a victorious struggle against the microbe; this is the part of therapeutics. On these two points, also, social influences have an extremely active effect. These interventions may be greatly modified by the position of the subject in society, and rendered, according to circumstances, insufficient and illusory, or more efficacious and even potent.

The facts thus far glanced at in this rapid review relate only to isolated cases, or to diseases which reach and kill only a few subjects. Suppose, however, these pathogenic influences raging at their extreme height; we shall then be dealing with epidemics carrying men off by thousands, by hundreds of thousands, as actually takes place with cholera, yellow fever, and the plague. Under such circumstances the microbe performs destructive work, carries death abroad, and decimates populations.

So we are brought back to the beginning of this discussion; and, examining philosophically this phase of the complex question of the office of the microbe in society, we are able to answer Broca's question, quoted at first, "What will take place in future generations when they shall have exhausted the temporary resources of emigration?" We say: Then the microbe will intervene, as it does periodically; it will decimate populations and will sow death; but it will be to renew life by enabling new existences to take the place of those which have become extinct, and by furnishing them, under an assimilable form, the organic matter which they will require for their life and healthy growth.

We thus see, even from this rudimentary sketch, that the function of microbes in society is very important. Good or evil, useful or injurious, they all have a part which is indispensable to the regular evolution of social bodies. Moreover, paradoxical as the assertion may at first sight appear, I believe the fact has been rigorously demonstrated, and may be formulated in the words, that society can not exist, live, or subsist except with the aid of the constant intervention of microbes, the great purveyors of death, but also the dispensers of matter, and therefore all-potent purveyors of life.—*Translated for The Popular Science Monthly from the Revue Scientifique.*

THE mass of the asteroids has been computed by B. M. Roszell, of Johns Hopkins University, and found—including the whole three hundred and eleven bodies whose elements had been calculated at the time—to be ·026 of the mass of the moon.

THE ILLUSTRIOUS BOERHAAVE.*

By WILLIAM T. LUSK, M.D., LL.D.

OF the serious questions which need to be considered at the outset of a professional career there is none more vital than that of personal conduct. This is recognized by the provision for the medical man of a code of ethics, which shows him how the portion of the ten commandments which teaches one's duty toward one's neighbor, is applicable to his dealings with the public and with other medical men. It is useful to the class which need to be reminded that for uprightness a man should do no murder, should not steal, should not bear false witness, should not covet. But the sweetness and light which should govern our relations to others are not the product of written law. The real training comes from action with attendant victories and defeats. There is, however, a special inspiration to higher effort which is derived from the study of the lives of distinguished men. For this reason I have thought it might be profitable for you to follow with me on this occasion the career of the Dutch physician HERMANN BOERHAAVE. In his day his fame was world-wide. A letter addressed to the "illustrious Boerhaave, physician in Europe," by a mandarin in China, in those days of limited communication, reached him without inquiry or delay. In the history of medicine he ranks as the peer of Hippocrates and Sydenham.

He was born in Voorhut, a small village, two miles distant from Leyden, on December 31, 1668. His father, James Boerhaave, was a poor minister with a large family. He had, as we learn from a few but very precious memoranda left by his famous son, a good acquaintance with Latin, Greek, and Hebrew, and was well versed in historical studies. He was, in fact, a modest scholar, simple and unpretending, but with high ideals, and respected by all for his probity and honor. With special gratitude the son recalls the self-denying economy by which the father sought to provide the means of educating his nine living children.

James Boerhaave was twice married. Hagar, the mother of Hermann, died when he was five years old. She left seven children. From her Hermann inherited his taste for natural science. At the end of a year, James married a Mrs. Dubois, a minister's daughter. By her he had six children, but, owing to her obliging, impartial disposition, the old home sheltered an undivided family. In his memoranda Hermann commemorates the

* An address delivered before the graduating class of the Medical Department of Yale University, June 26, 1894.

"*mores sanctissimos, raram virtutem, amabilem indolem*" of this beloved stepmother.

The elder son by the second marriage, James was selected for the medical profession, but the influence of heredity was too strong. He tired of physic, and became an eminent divine at Leyden.

Hermann, on the other hand, was designed for the pulpit. His maternal grandfather, Hermann Daeldir, was famous as a maker of instruments of navigation in Amsterdam. His mother was regarded as a great authority in the simple medication for the parish poor. He was brought up to regard divinity as the highest of all professions, and was deeply imbued with the religious sense; but his native instincts and tastes were always for scientific investigation, and a trivial incident made him one of the greatest physicians of all times. In after life, when at the zenith of his fame, he modestly wrote a dedication of his work on chemistry to his brother; in referring to the plans laid out for them both in their boyhood he says: "Providence disposed of us otherwise; and exchanging our views, consigned you to the service of religion, and made me, whose talents were unequal to higher things, humbly contented with the profession of physic."

At eleven, under his father's instruction, he was well versed in Latin and Greek, and ready at the grammatical rules of both tongues, for to be a good grammarian was the ambition of the countrymen of Erasmus. To write Latin with elegance and ease was essential when the Latin language was the means of communication between learned men over the entire civilized world.

In those childish days it is interesting to learn that the serious minded boy delighted in devoting his leisure hours to the culture of the little garden of the parsonage. Holland was then, Griffin tells us, the gayest garden land of Europe, and later, under the skilled direction of Boerhaave, the botanical garden of Leyden became the most renowned in the world.

From the twelfth to the seventeenth year the boy suffered greatly from hip disease. He tells us it was the grievous pain from this source which led him to contemplate the study of medicine. But the malady seems scarcely to have affected his progress in his studies. At fourteen he was sent to the public school in Leyden, where he was rapidly advanced in his studies, winning all the prizes, and at sixteen, he was admitted to the university. It may here be parenthetically stated that the schools of Holland were the best in the world. They received state aid, and were free to the needy student.

Meantime the father of Boerhaave had died, and left his family in straitened circumstances; but, in Leyden, where, after its heroic siege, while the memory of plague and famine was still

fresh upon them, its people had asked for a university in place of the proffered exemption from taxation; in Leyden, which, when Scaliger was invited to a professorship, had ordered a ship of war to receive him, a helping hand was always outstretched to aid the meritorious student. Trigland, one of the divinity professors of the university, who had been a friend of Boerhaave's father, and who entertained great expectations as to the boy's future, procured for him the patronage of Van Alphen, the burgomaster, to whose paternal, continuous, and benevolent interest Boerhaave renders grateful tribute.

While a student at the university, by the advice of his instructors, in addition to studies in Greek, Latin, Hebrew, and Chaldee he attended lectures on natural philosophy and mathematics. During his undergraduate course he was often called upon by Siguerd, his professor, to take part in discussions upon the latter subjects. The study of algebra, geometry, and trigonometry he tells us he found most entertaining. In his twenty-first year he delivered the academic oration upon the subject that "the Doctrine of Epicurus concerning the Chief Good was well understood by Cicero," for which he received the gold medal.

It may perhaps be of interest to recall at this time the dignified formalities with which the competition for university honors was then surrounded.* The candidate first announced his intentions to the rector and senators, and these in turn informed the curators, who appointed the day for the oration. Then the applicant waited on each of the curators, and on the chief magistrate and sheriff of the city, to desire their presence. If the oration gave satisfaction to the curators, their secretary was sent to his habitation to thank him in their name, and to acquaint him that he should be presented with the gold medal. This was worth thirteen pounds, and bore a Pallas in relief on the front, and an engraved inscription relating the name of the person and the occasion on the reverse.

"The University of Leyden," Thorold Rogers tells us, "was far more renowned in the seventeenth century than Oxford, Cambridge, or Paris, and students from all countries crowded into this the youngest of the great universities. The student was exempted from taxation; he received his wine, beer, tea, coffee, salt, soup, and books free; and when once his name had been on the university rolls he was amenable for all offenses to a special court composed of the rector, four professors, and a representation in the city magistracy. One of the gravest punishments with which he could be visited, in the popular apprehension,

* Burton's Life and Writings of Boerhaave, 1746, p. 9.

was banishment from town for a term of years, and deprivation of academic privileges.

After receiving his philosophical degree, Boerhaave entered upon his theological studies. He delighted, he tells us, in the primitive fathers, whom he highly reverenced for the purity and simplicity of their doctrine, for the sanctity of their instruction, and for the perfection of their lives, dedicated to God; but he had no patience with the efforts of the schoolmen to make the sacred writings conform to the metaphysical abstractions of Plato, Aristotle, Aquinas, Scotus, and Descartes, with the confusion ensuing, and with an outcome, as he regarded it, contrary to peace with God and man. Independent judgment, it may be stated, was not favorably regarded in those days by the orthodox in Holland.

Meantime, to aid in his support, Boerhaave received a small number of pupils for private instruction, and, contemporaneously with his religious exercises, he took up the study of anatomy as a diversion. To him the works of Vesalius, of Fallopius, and of Bartholin were of absorbing interest. He attended likewise the dissections of Prof. Nuck, and with the true scientific spirit, eager for personal observation, he frequented slaughterhouses, and sought to increase his knowledge by vivisections. Anatomy was then to the student a revelation, and not a compulsory task. Chemistry, too, with the hopes it inspired of new and wonderful discoveries, filled him with splendid dreams.

Thus it came to pass that while loyal to his father's wish that he should devote his life to the ministry, and though still believing that his duty lay in that direction, he decided that he would, in addition to his theological studies, take a degree in medicine. For that purpose he entered the University of Harderwick, and in July, 1693, was made a Doctor of Physic. There now occurred to him one of those accidents which happen to most men at some time in their career by which the nature of their life's work is determined for them independently of their volition. On his way home from Harderwick a discussion was started on the passage-boat about the doctrines of Spinoza as subversive of all religion. Now, the universal education which was the glory of Holland bred a goodly number of blatherskites as well as famous scholars. One of the former was filling the air with loud invectives against the great philosopher; whereupon Boerhaave quietly asked him whether he had ever inspected the works of the author he decried. The clamorous orator, Burton tells us, was struck dumb. Inquiry was at once made as to the name of the troublesome student, and, after their arrival in Leyden, it was soon current gossip that Boerhaave had become a Spinozist. Strong opposition was organized to his receiving a license to

preach. On the advice of his three steadfast friends—Van Alphen, his earliest patron; Trigland, the most famous of the instructors in the theological department; and Van der Berg, for some time burgomaster, a man of wealth and great influence—Boerhaave decided not to risk a refusal, but to devote his life to the practice of medicine.

He had already a reputation for prodigious powers of intellect, and those who knew his easy mastery of every subject to which he directed his attention anticipated for him a most brilliant future. Yet for a long time few patients sought his counsel. While awaiting at Leyden the advent of remunerative practice, he was invited by a prime favorite of King William to settle at the Hague and to establish himself as a court physician. But this temptation he resolutely put aside. He devoted the waiting period which falls to the lot of most young physicians to teaching mathematics, to work in a laboratory which he fitted up in his own domicile, and to reading the Scriptures and those authors who best teach the true way of loving God.

It may be interesting to state that Leyden, in the seventeenth century, according to the account of John Mollett,* was "rich and prosperous, beautiful, clean, and pleasant, abounding in handsome houses, intersected with canals of fast-running water, its broad streets planted with trees; its houses of red brick, faced with white masonry, shadowed the pathways with their projecting gables; and their ornamentation of arches, festoons, and medallions carved with quaint and heraldic devices completed a style of architecture that was characteristic and charming. Above these houses rose a large and splendid Town Hall, two beautiful Gothic churches, and a number of buildings originally dedicated to religious but at that time to secular uses."

The city, in the height of its prosperity, had a population of nearly one hundred thousand souls. The most perfect order prevailed. At the same time there were everywhere activity, vigor, and exuberance of life. It had a wide fame for the product of its looms, and Leyden cloth, Leyden baize, and Leyden camlet became familiar terms at home and abroad.† It was the birthplace of Rembrandt, Jan Steen, and Gerard Douw. Important works of every kind issued from its printing presses. The classic editions of the Elzevirs of Leyden are still the book-lover's delight.

In this favorable environment, Boerhaave's mental powers were ripened by observation and study. In 1701, in his thirty-third year, he was induced by his friends, on the death of Drelincourt, to lecture on the institutes of physic. His success was

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* Rembrandt, by John Mollett. The Great Artist Series.

† British Encyclopædia. Art. Leyden.

such that at the end of his course his delighted pupils prevailed upon him to instruct them in chemistry likewise.

Two years later he was invited to a vacant professorship at Groningen, which he declined with grateful acknowledgments. Thereupon his trusty friend Van der Berg, President of the Burgomasters and one of the seven curators of the university, induced the authorities to increase his salary, and to promise to him the first vacancy in the regular professorships. This did not occur until 1709, when, on the death of Dr. Hotton, he was made Professor of Medicine and of Botany.

By the aid of returning captains, at a time when Dutch ships ruled the sea, and by a system of exchanges with noted correspondents, in ten years he had doubled the number of plants in the botanical garden. Crocodiles, turtles, and other strange creatures were imported from distant settlements in the Indies. The bamboo, the papyrus, the palm, the coffee plant, trees of cinnamon, camphor, and mahogany could be seen growing in the open air and in hothouses. The plants were especially remarkable for their strength and vigor. In their classification Boerhaave prepared the way for Linnæus.

In 1714 Boerhaave was elected to the rectorship of the university—"of their Noble High Mightenesses' University of Leyden," he terms it in his correspondence—and in the same year was appointed Professor of Physic in place of Prof. Bidloo, and to a position in the University Hospital. By this time his fame had outgrown its local limits, and students flocked to him from all parts of the world. When he began his public teachings, the doctrines of Van Helmont and Paracelsus were held in high favor. Indeed, he tells us that the works of the former he read through seven times and those of the latter four times. Van Helmont he regarded rather as a philosopher than as a physician, as his boasted remedies fell far short of their promised efficiency. Yet Paracelsus swore by his own soul, and calls every god in heaven to witness, that with one single remedy he was able to cure all diseases, be they what they would; and in another place he declares that no one need scruple about getting certain secrets of physic from the devil, and boasts of holding conversations with Galen and Avicenna at the gates of hell. By the school of Paracelsus it was claimed that the doctrine of transmutation was contained in the Pentateuch, in the books of Solomon, and in the Revelation of St. John.

Van Helmont's methods are illustrated by an account he gives us of how he treated himself for pneumonia. In 1640, in the sixty-third year of his age, he was seized with a fever, attended with a slight shivering which made his teeth chatter; a pricking pain about the sternum, a difficulty of respiration, and a spitting first

of bloody matter and then of pure blood. For the removal thereof he took certain scrapings, which seem to have been in anticipation of the animal extracts of the present day, upon which the pains grew less. Then he took a drink of goat's blood, and the spitting of blood ceased in four days, leaving only a slight cough with a moderate expectoration; but the fever still remained, and was followed by a pain in the spleen, for which he took wine boiled with crabs' eyes, whereupon all the symptoms disappeared.

Medicine was not only obscured by the vagaries of the chemists, but knowledge was darkened by the theories of philosophers, who sought by shutting their eyes to arrive at truth by purely intellectual processes. Now, Boerhaave's teaching was an unceasing protest against the errors of his times. His introductory oration at the beginning of his career as a teacher was one extolling Hippocrates. To you, to whom the father of medicine is probably little more than a name, it may be proper to mention that the veneration in which he has been held is due to his having been the first to found medical teaching upon naked and indisputable facts. He was the nineteenth physician in succession in the same family. The records of his forefathers, the fruits of travel, the clinical experiences upon the isle of Cos, and the reports of his pupils formed the material of his Observations, which still are read with wonder and with profit. After him, from Galen to Vesalius, great advances were made in anatomy, and Harvey had discovered the circulation of the blood, but there was little contributed to the practice of medicine until Sydenham—the "immortal Sydenham" Boerhaave loved to term him, though at that time his merits had not been recognized by his own countrymen.

The qualifications of Boerhaave for the reconstruction of medicine were extraordinary. His memory was amazing. He had a familiar acquaintance with the works of his predecessors in medicine and in the kindred sciences. He conversed in English, French, and German, and could read easily Italian and Spanish, so that few new reports from those countries escaped his notice. He had studied with profit the writings of Lord Bacon, of Sir Isaac Newton, and of Robert Boyle. He had followed with eager interest the microscopic discoveries of Malpighi, Leuwenhoeck, and Ruysch, and he had a vision which could overlook the entire field, and see all branches of knowledge in their proper relations. With such gifts and training his Institutes of Medicine, published in 1707, in which all the teachings in anatomy, in physiology, and in pathology up to his time were, after the severest personal scrutiny, made the foundation of the theory and treament of disease, rapidly became the text-book of Europe and of the East, and long remained in the hands of his pupils the basis of medical teaching. Yet there were so-called "practical

men" in those days who received the work with scant favor. They boasted that they read nothing; that all available knowledge was the product of experience only. They sneered at museum doctors, and said that such were not fit to doctor a cat.

But Boerhaave's greatest glory was the prominence he gave to clinical instruction. Instead of aimless wandering through the hospital wards, he adopted the plan of examining few patients, but with them to be exact, thorough, and exhaustive. At the bedside he taught with great minuteness the conditions that prevail in health, and then the changes wrought by disease, and upon these data he proceeded to formulate his therapeusis. Under him the post-mortem room assumed the same importance as the library, the chemical laboratory, the dissecting room, and the botanical gardens. His pupils in other lands established clinics and clinical instruction in conformity with the precedents he established. The clinical schools of Edinburgh and Vienna, under the guidance of Cullen and Van Swieten, owe their glory to his transplanted spirit.

His system of treatment, like that of Sydenham and Hippocrates, comprised few remedies, and laid great stress upon hygiene. He had little faith in the prevailing *elixirs ad longam vitam*. "As to nostrums," he says, "let those who have them keep them till they can convince impartial observers of their real worth." In a footnote to this, Burton, who was his Boswell and worshiper, says, "Mrs. Stephens' saponaceous dissolvent for stone in the kidneys and bladder may be a proof of one of them."

In 1718 he accepted, in addition to his other public positions, the professorship of chemistry, then left vacant by the death of Le Mort. In 1738 he published his Elements of Chemistry. It is divided into three parts. The first is historical, and is full of curious learning; the second part presents Boerhaave's theoretical views; while in the third part the author's personal observations are given. These are chiefly of interest as showing the volume of useless experimentation that preceded solid advances in chemical science.

As a sample of old-time ways, Burton, with loving admiration, details Boerhaave's attempt to accomplish the consummate purification of quicksilver. "With matchless perseverance he tortured it by conquassation, trituration, digestion, and by distillation. He amalgamated it with lead, tin, or gold, repeating this operation to 511 or even to 877 distillations." But alas! owing to an inherent turpitude in the metal, at the end it was only the same quicksilver as at the beginning.

That this and similar experiences were not satisfactory to Boerhaave is evident from his preface. The work, he complains, was produced at the instance of his friends, and because of spuri-

ous accounts of his lectures which were then in circulation. "This brought Petrarch to my mind, who bewails the unhappiness of his age upon finding himself ranked among the chief poets in it. With what confidence could I, conscious of my own insufficiency, and full of admiration of other authors, enter the list of writers of chemistry? At length, however, I undertook the disgustful work which I now declare was extorted from me."

In his prime Boerhaave was tall, robust, and athletic, hardened by exercise, negligent in dress, with a large head, curly brown hair, bright, piercing eyes, and a florid complexion. He was a sincere and affectionate friend, courteous in his professional intercourse, never talking of his own affairs, ready with praise for others, but silent concerning himself.* "There was in his air something rough and artless, but so majestic and great at the same time that no man ever looked upon him without veneration and a kind of tacit submission to the superiority of his genius." He rose at four o'clock in summer and at five in winter. Ten was his usual bedtime. One hour he devoted to prayer and meditation. This, he said, gave him spirit and vigor in the business of the day. All his abilities he ascribed to the goodness of God. In the severest winter he had neither fire nor stove in his study, where he passed three to four hours in the morning. His library abounded in the works of the best historians, poets, and authors of polite literature as well as in those upon medicine.

By unceasing industry he produced in rapid succession books, minor treatises, orations, and discussions. Besides the public lecture on botany and the private lectures on chemistry, the institutes and practice of physics, which employed him four hours in speaking, he frequently spent an hour in giving a public lecture on some special subject. He allowed nothing to interfere with his duties as a teacher.

He brought to the lecture room a vast comprehension, a prodigious memory, and a solid experience. He used no notes; his manner was concise, clear, and methodical. He illustrated his subjects with quotations from the poets, of which his favorites were Virgil, Ovid, Rapin, and Cowley. Sometimes by a delicate irony he stirred his audience to laughter, but never moved a muscle of his own face. His lecture room was thronged. Men came to Leyden from all parts of the world, who regarded it as a special glory to have been taught by the illustrious Boerhaave. As a writer said of him after his death: "Long was he the oracle of his faculty. Never was preceptor more beloved, professor more celebrated, nor physician more consulted." †

His practice was enormous. A hundred patients, it is said,

* Gentleman's Magazine, 1739.

† Burton, footnote, p. 73.

were frequently waiting in his anteroom. The Czar Peter once lay all night in his pleasure barge outside of Boerhaave's house, to have two hours' conversation with him before college time. He was temperate in his habits. He rarely touched wine. Water was his common drink. In the German student song it reads:

> "Hermann Boerhaave schreibet ja:
> Aqua paullo frigida
> Potio est optima."

Until infirmity came upon him his favorite exercise was riding. When he was weary he distracted himself with music, of which he was very fond. He had a good voice and played a number of musical instruments. It was his custom to have a weekly concert at his own house.

At forty-two he married Mrs. Mary Drolenveaux, the only child of the Burgomaster of Leyden. They had four children; three died in infancy—one, a daughter, survived him.

In 1722, when fifty-four years of age, his physical constitution gave the first warning of the effects of the strain to which it was subjected. He had an attack of arthritis, whether of a gouty or rheumatic nature is uncertain, though it is stated that it was the result of exposing himself to the morning dews before sunrising, which kept him in bed six months. The pains were atrocious. Once, after fifteen hours of continued suffering, he prayed that his disease might end his life and misery. This afterward gave him great concern, for he wished, he said, to abide by this maxim living or dying: "That only is best, and alone to be desired, which is perfectly agreeable to the Divine Goodness and Majesty."

When in 1723 Boerhaave had sufficiently recovered to reopen his private college, the citizens of Leyden celebrated the event in the evening by illuminations and by public rejoicings. In 1727, on a return of the attack, he gave up the chairs of chemistry and botany, though he continued to teach actively in other branches until his final illness. In his later life his greatest pleasure was in his country home. This was large and roomy, with eight acres of ground. His garden was filled with the exotic shrubs and trees which would flourish in that climate. A present of American shrub seed he styles "a gift more precious than gold," and two cedar trees "a royal benefaction."

In 1725, at the expiration of his rectorship, he delivered an oration in which he reprehended the philosophers who have attempted to invent rather than to discover principles, and in particular he singled out Descartes. Andala, an orthodox Cartesian professor, set up a cry that the Church was in danger, and that the dreaded evil of Spinozism would be the result. But the times had changed since the journey of the young student from Harder-

wick. The governors of the university insisted on a retraction. To Andala's recantation Boerhaave replied with fine courtesy that the most agreeable satisfaction he could receive was that so eminent a divine should have no more trouble on his account.

Boerhaave was through life cheerful and desirous of promoting mirth by a facetious and humorous conversation. He was never soured by calumny and detraction, nor ever thought it necessary to confute them, "for they are sparks," he said, "which if you do not blow them will go out of themselves."

In 1728 he was elected a member of the Royal Academy of Sciences in Paris, and in 1730 a member of the Royal Society.

He accumulated an immense fortune, estimated by some at two millions of florins, and yet through life no one appealed in vain to his generosity. "The poor," he said, "were his best patients, for God paid for them."

About the middle of the year 1737 he began to suffer from cardiac disturbances, from dyspnœa, and from dropsy. If for a moment he fell asleep, the respiration was interrupted, and rest was prevented by a terrible sensation as of strangling. Yet in a letter he writes, "I have lived to upward of sixty-eight years, and always cheerful."

In the library of the Faculty of Medicine in Paris there were found in 1877 ninety letters from Boerhaave to his friend Baron Bassand, physician to the Duke of Lorraine, afterward the Emperor Francis I. In one of these, written two weeks before his death, and intended for private eyes only, he says: "My malady gathers in force. The cardiac oppression due to polypi is constant, and of the last degree of cruelty. God wishes it thus. His perfect and sovereign will be glorified by the submission of his creature, who loves and adores only the infinitude of the eternal." *

He died on the 27th of September, 1738. His monument in the St. Peter Church, where his body was interred, bears the inscription "Salutifero Boerhaavii Genio."

* Article by Chireau, L'Union Médicale, 1877, p. 584.

CORRESPONDENCE.

STEEL ENGRAVINGS AS WORKS OF ART.

Editor Popular Science Monthly:

In the article on bank-note engraving, published in your March issue, the writer classes the engraving of bank notes among the fine arts, and describes it as the last and highest step in a long series, beginning with the wood and metal engravings of Albrecht Dürer. Just what analogy the writer finds between the metal engraving of Dürer and modern bank-note work is by no means obvious, although his statements in regard to this artist are doubtless authoritative, as they are taken entire, with scarcely the change of a word, from Philip Gilbert Hamerton's article on Engraving in the eighth volume of the Encyclopædia Britannica, page 441. But, as Dürer was an artist and not an animated cycloidal lathe, he is scarcely to be compared with the modern engraver of bank notes. There is not even similarity between the materials used, for Dürer's medium was copper or wood, while the modern bank-note plate is of steel. I can not forbear slight criticism, because, in an article otherwise instructive and valuable, the writer manifests a complete and utter misapprehension of the meaning of art as such. Mr. Dickinson hopelessly confounds steel engraving and etching, and deplores the lack of "original artists" in these lines of work, for, says he, "steel engravings have found a place in the hearts of the people of this country that no other class of art can ever replace." It is somewhat ludicrous to think of placing Seymour Haden, Rajon, or the immortal Whistler on the level of the producers of steel engravings, which are, in general, the most inartistic and lifeless things ever allowed to masquerade under the name of art. Of copperplate, the scroll and papyrus of our etchers, Mr. Dickinson speaks disparagingly because it wears out "in one thousand impressions, while ten or fifteen thousand can be taken from steel." He generously adds that it is "still used to a considerable extent for visiting cards," and "in some cases for the cheaper classes of picture work, such as book-illustrations," evidently ignorant of the fact that numbers of our greatest artists—Reinhardt, Gibson, Frederic Remington, Irving R. Wiles, and W. T. Smedley, among others—consider their art in no wise cheapened or degraded when turned into the enormously profitable channel of "picture work, such as book illustrations."

Says Mr. Dickinson, "Here [in a bank-note portrait] we have a beautiful specimen of pure line engraving, much better than most of that done by some of the old masters and now considered classic." Now, it is not the fault of the bank-note portrait that scarcely anything more mechanical, more uninteresting from an artistic point of view, has ever been produced, but it is doubtful if ever before it has been looked upon as possessing genuinely artistic value. And this difference between mechanism and art is just what Mr. Dickinson has utterly failed to perceive. A work of art lays claim to that title only when the means of expression remain subordinate to the thought which is expressed. Technique alone will not save any work of art from more or less speedy oblivion, while a serious thought, even though inadequately expressed, will remain a dominant tone in the chord of the world's art for all time. The technically faulty works of the early Italian artists, and even of Dürer himself, give ample proof of this. Then, too, a work of art is never more than merely suggestive—never, as in the case of the bank note, is it elaborated to painful completeness. A mechanical draughtsmanship, such as is displayed in the bank note, crams the same conclusion down the consciousness of each and every onlooker. The genuine work of art remains obstinately silent, or else pours out its wealth of color and song lavishly, according to whether the spectator be a poet at heart or a dolt.

In a bank-note engraving, on the other hand, the sole interest aroused is in the process, and this interest is heightened in proportion as the process involves greater intricacy of detail and more rigid and unvarying evenness of line. Since that so-called perfection is due chiefly to the accuracy of machinery, "the ruling machine, and cycloidal and geometrical lathes," a bank note can have no other than a purely mechanical interest. The engraving of it is doubtless a valuable factor in the commercial world, but to compare it to the work of Dürer, crown and flower of the German Renaissance, is quite like comparing a lathe-turned table leg to the Moses of Michael Angelo.

Grace Green Bohn.

Chicago, *March* 2, 1895.

EDITOR'S TABLE.

PUBLIC EDUCATION AND PUBLIC OPINION.

THE editor of the Revue des Deux Mondes contributes to a recent number of that periodical an article entitled Education and Instruction, in which are some things with which we heartily agree and others from which we are compelled to dissent. The article as a whole, however, is of undoubted value, inasmuch as it sets forth the true theory of education, while what we regard as errors are in matters of detail. M. Brunetière remarks at the outset that formerly the ideas of education and of instruction were but little distinguished from each other. True, to instruct meant "to furnish," and to educate meant "to lead forth" or "develop" and so "to mold"; but it was always assumed that the furnishings provided for the mind would be of such a nature, and would be so imparted, as to promote development and favor true culture; and thus the words were to a great extent used interchangeably. In the present day we are compelled to separate their meanings, owing to the fact that, in our modern systems of so-called "education," while much effort is concentrated on fitting up the mind with an equipment of knowledge, the right direction of mental growth, and, above all, the right development of character, receive but little attention, and indeed are almost left out of sight. Our children are *instructed* in the schools of to-day; but, he maintains, they are not *educated* in the true sense. Personally, he expresses his regret that education was not allowed to remain a private matter; but seeing that it has passed into the hands of the state, we have simply to see what we can do to get the maximum of good out of the huge mechanism which the state has set up.

Now it might readily have been supposed by any one speculating before the event, that when state education became general it would at least have one strong point: it would aim at fitting the rising generation for social and political life; it would aim at overcoming or at least tempering in the interest of the community the natural selfishness of the individual. The error in this calculation would have lain in imagining that the state, as represented by individuals, has any consciousness of its own interests. The individuals in question have a consciousness of their own interests; the best among them have, in addition, some sense of public duty; but the state can not, through the officers and teachers it appoints, study and strive after its own interests as the individual studies and strives after his. Hence, in any system of public education, the claims of the state never get more than a partial and fitful recognition: the whole drift of the work done is in the direction of an intensified individualism, or, as M. Brunetière expresses it, "*la culture intensive du Moi*"—the intensive culture of the Ego. Referring to the statement made by Sir John Lubbock that the progress of education and that of morality kept pace in England, M. Brunetière exclaims: "Happy England! and most fortunate accident! for statistics have brought nothing similar to light in France or anywhere else, in Germany or in America. In these countries, on the contrary, we see that quite ignorant

people, who know neither antiquity, nor the sciences, nor languages, nor even orthography, are nevertheless very worthy folk; while inversely we find that all their instruction has not preserved a number of unfortunates from the worst lapses; and neither certificates nor diplomas have prevented them from succumbing to the most vulgar temptations." As applied to this country the writer's language is a little lacking in exactness; for here the conditions are such that it is difficult, for native-born citizens at least, to remain ignorant of the arts of reading and writing except through fault of their own; but it certainly has been the case in the past everywhere that people could be, as he says, "*fort honnêtes gens*" without any tincture of what we now call education. Their knowledge was confined to some useful art by which they earned a living, and the precepts of common morality.

The question M. Brunetière next discusses is how "to put some soul back into the school," or, in his own words, "*rendre une âme à l'école*"; but his observations on this point, referring as they do to a system of education controlled by the national Government, have but a slight application to this country. It is here, however, that we find ourselves disagreeing with some of his incidental remarks. He accuses men of science of being excessively dogmatic in their opinions, and apparently ignoring the modern conception of the relativity of knowledge. Now, some men of science may be dogmatic, but to say, as the learned editor does, that "most of these will not allow their conclusions to be disputed, or so much as criticised," is to fall into great exaggeration. As to the doctrine of the relativity of knowledge, it is a doctrine which science has established. It is earnestly and constantly insisted on by Auguste Comte, and has been illustrated and elaborated in great detail by Herbert Spencer. It is not, however, a doctrine of which much use can be made in imparting scientific or any other knowledge to the young, whose natural philosophic creed is one of simple confidence in the reality of phenomena. M. Brunetière is further of opinion that science should only be given in very small and judicious doses in primary and secondary schools. The important thing, in our opinion, is, that nothing should be done to check the spontaneous activity of youthful minds, or any flow of emotion which may be associated therewith. Science should, therefore, not be imparted to the young in too didactic or formal a manner; it should rather come to them in the form of a constant appeal to investigate, to use their own faculties of sight, touch, hearing, smell, and to draw their own inferences from data thus collected. We quite believe that, in the hands of an inexperienced and unsympathetic teacher, science lessons might be given to youthful students in such a way as simply to check imagination and inspire distrust in the testimony of the senses; but when the right kind of science teaching can be got, there will be no need to deal it out as the dangerous drug which the editor of the Revue des Deux Mondes seems to consider it.

Returning to the question on which, as we have stated, this writer does not give us much help—how to get "soul" into the schools—we must observe that any success in such an effort will depend largely on public opinion. The great mischief of an imperfect educational system is that it creates the public opinion by which itself is judged. The man of thirty-five, who to-day has children of his own at school, was a scholar himself

only twenty years ago. Things have not changed much in that time. If the spirit of competition was stamped into him, he will want it stamped into his children. If money is his chief preoccupation, he would not like to hear that a public-school teacher was doing anything to lessen the importance of money in their eyes. He would be willing enough that other children should learn that lesson, but not his own. The case, we are persuaded, is far from being an imaginary one. The average parent sends his children to school with no other view than that they shall be prepared for some money-making occupation; and he expects that that object shall be kept uppermost by the school authorities. This being the case, the "soul" that M. Brunetière desiderates runs a great risk of being contraband of our modern school systems; because it can not enter without coming at once into conflict with the spirit of money-worship, and also with that of selfish ambition. Of course, if we had every reason to be satisfied with the moral progress of our people and the signs of the times generally, there would be no need to raise this question; we might assume that the schools were doing all that was required of them: but such is not the case; the signs of the times are in many respects unsatisfactory. The state has wrenched education from private hands, and now we have to consider what can be done to humanize the teaching which it is bestowing on the millions of our youth. Very many individual teachers are doubtless occupying themselves with the problem, but their efforts will not make up for general public indifference to it. A nation can not thrive on love of money, nor live on the virtues of a small minority. We must have "soul," or, to speak with more precision, the spirit of social duty and of moral responsibility, at the very base of our educational systems; otherwise education itself becomes a fraud and a snare, and the very agencies which should consolidate the social fabric will work for its disruption.

THE ALLEGED DOGMATISM OF SCIENCE.

In the above article we have touched, in passing, upon a charge very frequently and very carelessly made against men of science that they are intolerant of opposition to their scientific theories, and in effect set up a kind of orthodoxy to which all must bow who desire to be considered rational and intelligent beings. The charge is utterly frivolous, as the most obvious facts attest. Consider first how it applies to some of the most prominent scientific workers of the century. Surely nothing of this kind could truthfully have been said of such men as Sir Humphry Davy and Michael Faraday, of Sir Charles Lyell or of Agassiz, of our own geologist Dana or our great botanist Gray. As to Darwin, all the world knows that candor and modesty were of the very essence of his character. We might pass rapidly in review a number of other eminent names the very mention of which would be a vindication from the charge, but it would be superfluous. When dogmatism appears it is nearly always on the part of men who have adopted their opinions at secondhand, and who have either ignored altogether, or paid little attention to, those elements of uncertainty which were not only fully present to the minds of the originators of the theories in question, but also fully expressed in their published works. This simply means that scientific leaders have the same experience that other leaders have had, and need to join in the

classic prayer, "Save us from our friends!"

There is one feature in the case, however, which is not to be overlooked, and that is that the representatives of science have been in the past, and still are to some extent, required to put up with a kind of opposition that is very annoying to men who have worked their way by patient labor, in appropriate fields of observation, to certain well-demonstrated conclusions. We refer to the opposition of those who have not labored at all in those fields, but who, on the strength of the most extraneous considerations, insist that certain scientific conclusions must be all wrong. Such was the opposition made by the Catholic Church to the modern system of astronomy, and such the opposition made by all Christian churches, more or less, to modern geological science. What is the use of inquiring into the origin of language and the affinities of different families of speech if the stories of the Garden of Eden and the Tower of Babel are to dominate all speculation on these subjects? The indignation used to be all on the side of the theologians, when their opinions were traversed by considerations drawn from the study of Nature. Nowadays scientific men allow themselves occasionally a little indignation, or at least impatience, when theories, which they have carefully founded on facts, are traversed on the strength of other men's interpretations of a book. Time brings about these changes, and it would be harsh to find much fault with the champions of science for not being wholly above the infirmities of human nature.

It should, of course, be clearly understood that dogmatism, in so far as it exists, does no good to science. True theories will vindicate themselves in the end; and, even when the grounds for certainty seem ample, it is well not to be too confident or too absolute. Then if people who simply *adopt* other people's opinions would only learn not to be more dead-sure than the authors and sponsors of those opinions, a great point would be gained and much trouble avoided. Science wants all the friends it can get, seeing that is a friend to all; but its path would be smoothed if ardent converts would temper their zeal with discretion.

SPENCER ON PROFESSIONAL INSTITUTIONS.

WHEN we wrote, in March, concerning the series of articles by Mr. Spencer with which this magazine began its career we had no thought that we should be so fortunate as to have the first of another series by the same master hand for the opening number of our twenty-fourth year. Nor had Mr. Spencer; for that editorial itself suggested to him the advisability of issuing serially the chapters on Professional Institutions which he had nearly completed. There will be eleven or twelve papers in the present series. These papers will show how the several professions have been differentiated from the functions of the priest or medicine-man, who is the only professional man of primitive society. They will demonstrate that in these affairs —although subject to human will and caprice—the grand principle of evolution operates just as surely and completely as in the derivation of an animal species from its ancestral form.

A peculiar element of value in the evolutionary philosophy, of which Mr. Spencer is the original and most eminent expositor, is the power of understanding the present and predicting the future which is afforded by its explanation of the

past. To take the present subject as an illustration, from the division of functions that has taken place in the past we may infer a still further specialization in the future. Higher achievements in the several professions may be expected as a result of this process, the men of different professions will become more and more necessary to one another, and the solidarity of society will be increased.

The Professional Institutions will form the last portion but one of the only volume remaining uncompleted in Mr. Spencer's systematic series of philosophical works. It therefore makes probable the successful completion of the series, and, together with the division on Industrial Institutions which is to follow, will be sure to throw much light upon the puzzling industrial problems of the day. A few days ago Mr. Spencer completed three quarters of a century of life and about half a century of productive labor in the field of thought. For twenty years past there have been times when the close of his labors seemed imminent, but, mainly as a result of prudent care, his physical strength has lasted till this time, while the articles of which we print the first this month adequately demonstrate that his mental grasp and acumen are in no wise impaired.

LITERARY NOTICES.

THE GREAT ICE AGE AND ITS RELATION TO THE ANTIQUITY OF MAN. By JAMES GEIKIE. Third edition. Largely rewritten. New York: D. Appleton & Co. Pp. 850. With Maps and Illustrations. Price, $7.50.

GEIKIE'S Great Ice Age, when it appeared in 1877, took a position at once as one of the standard treatises in geological science. It has held that place ever since, although the department of geology with which it is concerned has been more actively and scrutinizingly studied, perhaps, than any other. With so much research as has been bestowed upon glacial phenomena, much knowledge has been accumulated that was not within the author's reach eighteen years ago, and some new views have prevailed; yet Prof. Geikie's arguments so ably set forth in the first edition of his work have not lost their force, and his main conclusions have not been successfully assailed in their essentials. A revision of the book had, however, become necessary, in order that it might enjoy the benefit of the acquired knowledge, and that the new views might receive just discussion and the old ones be re-examined in the light of them. Yet in the immense bulk of the literature that has accumulated, and its scattered condition among many nationalities and in multitudes of periodicals and monographs, the author has not attempted to discuss all the interesting questions mooted and canvassed in it, but, to keep his sketch within reasonable limits, has been compelled to follow more or less strictly the lines laid down in the first edition, in which his endeavor was represented to be to give a systematic account of the Glacial period, with special reference to its climatic conditions. All the more important features of the evidence, however, have been considered, and few references are given to original sources of information. The chapters dealing with the phenomena of existing glacial action in Alpine and arctic regions have been touched up, and the glacial geology of Scotland has been thoroughly revised. Some rearrangements of other matter have been made; but nearly three fourths of the volume have been entirely rewritten. The glacial and interglacial deposits of the European continent are treated more fully than was possible ten or fifteen years ago. The purpose of the book being to sketch the present position of glacial geology rather than to write the history of its rise and progress, no great notice has been taken of the opinions held by its pioneers. In dealing with questions still under discussion the author has endeavored to avoid a controversial tone, preferring as a rule to set forth the evidence as clearly and impartially as he could, and then to point out what seemed the most reasonable interpretation. To avail himself as fully as possible of the results of

glacial investigation in America, where some of the fullest researches have been made, the author engaged Prof. T. C. Chamberlin to prepare a summary of the American evidence, which is presented in the forty-first and forty-second chapters of the book. An interesting confirmation of the author's conclusions, drawn most largely from observations of British geology, is afforded by those of Prof. Peunck, of Vienna, which are similar, though derived from the study of a different field—the Alpine lands.

GEOLOGICAL SURVEY OF NEW JERSEY. ANNUAL REPORT OF THE STATE GEOLOGIST FOR THE YEAR 1893. By JOHN C. SMOCK, State Geologist. Trenton: John L. Murphy Publishing Company. Pp. 457.

THE survey for 1893 was engaged in the continuation of the work on the surface formations of the State, on the greensand marl beds and the associated bed of the Cretaceous and Tertiary ages, on the study of stream flow and the general questions of water supply and water power, and on the examination of the clays of the State; and the collection of artesian or deep-bored well records was continued. The study of the surface geology by Prof. Rollin D. Salisbury was carried on mostly in the northern and central parts of the State. One of its fruits is the preparation of maps of the surface formations, separate from that of the underlying strata, in the beginning of the publication of which New Jersey leads. These maps may be said to make a new series, distinct from the topographic maps by their geology, and from the older geological maps in the absence of any representation of the older and underlying rock formations, except where they crop out and make the surface. They show the nature of the soils and subsoils in general, and the deposits of sands, gravel, peat, shell marls, and other earthy beds, and also the bowlder-covered areas of the glacial drift. The work in the greensand marl belt and in the newer formations of the Tertiary age overlying the marl beds was continued, in co-operation with the United States Geological Survey, under the charge of Prof. William B. Clark. The survey of the crystalline rocks of the Highlands was carried on by the United States Survey, and was in charge of Dr. J. E. Wolff. The subjects of water supply and water power were further investigated and studied by Mr. C. C. Vermeule, and the collection and tabulation of data for the volume of water supply were carried forward. Mr. Vermeule has prepared a map of the State showing the water sheds which are utilized for public water systems and those which are still available. Mr. Lewis Woolman has continued to collect the records of artesian wells put down in the southern part of the State; and his report contains, in addition, historical notes of wells and important generalizations on the water-bearing beds or horizons. Progress is reported in drainage surveys, and surveys for the reclamation of tide-marsh lands. Attention has been given to the adaptation of the trap ridges and highland regions to the purpose of natural parks and forest reservations. The last part of the report is devoted to a list of the useful minerals and mineral subtances which occur naturally in the State, and to notes on the localities and modes of occurrence. The volume contains the map showing water sheds, and is accompanied by a tube containing maps illustrating the distribution of intramorainic and extra-morainic drift; of the extinct Lake Passaic; showing glacial striæ on the Palisade range; and of the vicinity of Hibernia, in the ore district.

GENERAL HANCOCK. By General FRANCIS A. WALKER. Great Commanders Series. New York: D. Appleton & Co. Pp. 332. Price, $1.50.

IN telling the story of Hancock's life and military career General Walker draws attention to the fact that Hancock never commanded a separate army, and hence was never responsible for the plan, but only for the execution of the part intrusted to him, in the operations of the army with which he was connected. Hence he is to be estimated as an executive officer and not as a strategist. In two chapters his life is brought down to the great rebellion. Winfield Scott Hancock was the son of a lawyer who practiced a few miles out of Philadelphia. He went through West Point with the class of 1844, and served in the Mexican War, which began a couple of years after he graduated. From the evacuation of the city of Mexico until the civil war Hancock served much of

the time as a quartermaster, the last two years being chief quartermaster on the Pacific coast. In this service he won distinction for his care, foresight, and good management. General Walker represents him as having the almost incompatible qualities of loving "papers," rejoicing in forms and regulations and requisitions, while at the same time he had the temperament that enjoys the clash of battle with its excitement and danger. His experience had prepared him most admirably to cope with material obstacles, and very often it is material obstacles quite as much as the efforts of the enemy that defeat armies. In his first battle, Williamsburg, he was sent with five regiments to execute a movement, which he accomplished with consummate skill. His conduct led McClellan to say in his telegraphic report, "Hancock was superb," and the adjective clung to him. By what the author calls "one of those curious fortunes which mark the course of war," the brigade and its commander that had acted so brilliantly and steadily at Williamsburg were given scarcely anything to do in the seven days' battles and other fighting that followed on the peninsula, nor were they more actively employed at Antietam. But when Richardson fell on the last-named field, Hancock was advanced to the command of his division.

The account follows Hancock through Fredericksburg, Chancellorsville, and the three days of Gettysburg, setting forth the tactics employed by the Union army on each day and freely criticising them. The severe wound received by Hancock on the third day at Gettysburg took him away from the Second Corps, which he then commanded, for six months. After his return came the severe campaign of 1864, in which Hancock bore a prominent part, Grant being now his chief. In the spring of 1865, after a winter of recruiting service, Hancock was placed in command of the Middle Military Division whose operations were to begin from Winchester. The final crash at Petersburg came earlier than Grant expected, so that Hancock had no share in the operations which brought it about. A single chapter is given to the events of Hancock's life after the war. The position that General Walker occupied on Hancock's staff, of assistant adjutant general, makes him exceptionally well qualified for the work he has here performed. It is no eulogy that he has produced, for he does not conceal the deficiencies nor the specific mistakes of his subject. His incidental criticism of other generals is equally outspoken, and adds much to the interest of the volume.

METEOROLOGY. Weather, and Methods of Forecasting, Descriptions of Meteorological Instruments, and River Flood Predictions in the United States. By THOMAS RUSSELL. New York: Macmillan & Co. Pp. 277, with Plates. Price, $4.

THE main object of this book is to explain the use of the weather map, where it can be of service for the purpose of making predictions; but the author's expressions as to the feasibility of making successful predictions, even with the use of the weather map, are not hopeful. There are not more than from six to twelve occasions in the year when they can be made, and for some places they are never possible. The kinds of weather that can be foretold are the great changes. A fall of temperature as great as forty degrees can be foreseen to a certainty for most parts of the country east of the Mississippi River. The northeast rainstorms along the Atlantic coast can be successfully predicted in most cases. Floods along the lower Ohio and Mississippi Rivers can be foreseen from one to three weeks in advance of their occurrence, and the height the water will reach can be assigned within a foot or two. The course of rains, which agrees as a rule with that of the areas of low pressure that cross the country from west to east and from southwest to northeast, can be inferred in a general way, but is subject to many irregularities. The reader being thus warned of the uncertainties connected with the matter, a summary of what is known about the weather, its apparent laws, and its somewhat erratic movements, is given in a series of chapters which are broken up into crisp, pertinent, and intelligible paragraphs distinguished by their conspicuous headings. First, the influence of the moon, sun spots, and periodicity are discussed; we have no satisfactory knowledge on either point. Next, the properties and functions of the air are described, with more definite conclusions. Then meteorological instruments are enumerated, and the principles involved in their construction and their uses are explained. The succeeding chapters are

devoted, with numerous subheadings, to the discussion of temperature and pressure and their variations, evaporation, clouds, rain, and snow; winds, thunderstorms, and tornadoes, and optical appearances. A full chapter is given to the exposition of the construction and meaning of weather maps, and another chapter to the consideration of the import of weather predictions. A short account of river floods is given, and the method of predicting river heights for a number of points along the lower Mississippi River and its tributaries. In all this a general view is taken of meteorology, while climatology is treated of only in its broad, general features. The principal weather changes are described as they occur in various parts of the world in different seasons on land and sea, and their causes are narrated as far as is known. A collection of facts is given useful in forming a conception of the phenomena of the atmosphere as a whole, so as to enable those with little time for consulting a multitude of books to form a notion of the science of meteorology as it is at present.

THE BIRDS OF EASTERN PENNSYLVANIA AND NEW JERSEY. With Introductory Chapters on Geographical Distribution and Migration. Prepared under the Direction of the Delaware Valley Ornithological Club. By WITMER STONE. Philadelphia: Delaware Valley Ornithological Club. Pp. 185, with Two Maps.

THE object of this volume—which has been prepared by a special committee appointed to collate the field notes of members of the club—is to provide these members and ornithologists with a summary of our present knowledge of the birds of the district included, with regard to their abundance, distribution, and time of occurrence. Description of the birds and their habits does not come within the scope of the work. In the preliminary pages are given notes on the geographical distribution of birds; the faunal areas of the region; their physical features and characteristic birds; the distribution of winter birds; a general discussion of bird migration; migration in the vicinity of Philadelphia; and birds found within ten miles of Philadelphia—conveying copious information. The region is crossed by the three faunal zones: the Carolinian, occupying the southeastern corner of Pennsylvania and the whole of southern New Jersey, to the Hudson and beyond, with a bay up the Susquehanna Valley; the Alleghanian, occuing the rest of the region, except the tops of the higher mountain ranges and portions of the elevated table land in the north central part of Pennsylvania, where the Canadian zone is represented. The passage from the Alleghanian to the Canadian zone is, as a rule, remarkably distinct, as the more northern birds keep strictly to the virgin forest. Where the forest has been removed, the Canadian species for the most part disappear. These three faunal zones are divided into several well-defined regions which differ more or less in their physical features, and consequently in the character of their bird life; and these are described.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON AËRIAL NAVIGATION, held in Chicago, August 1, 2, and 3, 1893. New York: The American Engineer and Railroad Journal. Pp. 429.

THE proposal to hold the conference of which the proceedings are recorded in this book originated with Prof. A. F. Zahm, of Notre Dame University, who communicated with Mr. C. C. Bonney, President of the World's Congress Auxiliary, and interested several other persons in the project. The principal objects of the conference were to bring about the discussion of some of the scientific principles involved in the scheme of aërial navigation; to collate the results of the latest researches; to procure an interchange of ideas; and to promote concert of action among the students of this inchoate subject. The programme involved, first, a discussion of the general principles of the subject, and more special discussions in Sections A and B, under the heads of Aviation and Ballooning. Letters of co-operation were received from experts or students of the subject, and from the British Aëronautical Society, the Aërial Navigation Society of France, the Aviation Society of Munich, the Imperial Aëronautical Society of Russia, and the Aviation Society of Vienna. The sessions were attended by about one hundred persons, who seemed to take great interest in the proceedings, and the discussions brought out several investigators who had been studying the subject or trying interest-

ing experiments without making it publicly known. The opening address was by Mr. O. Chanute, and it is followed in the book by thirty-six other papers, on the work of the wind, propelling devices, sailing flight, soaring flight, the machines of flight and aspiration, forms of flying machines, aëroplanes, kites, balloons, explorations of the upper air, and discussions.

THE ILLS OF THE SOUTH. By CHARLES H. ATKEN, LL. D. New York: G. P. Putnam's Sons. Pp. 277.

DEMORALIZED labor, lost fortunes, a ruinous credit system, and the indirect consequences of Southern lien laws, are the chief subjects dealt with in this volume.

The book is penned in no hostile spirit to any one State or class of people, while to the student of modern history it forms a valuable adjunct to his historic knowledge of the Southern States. In all, the work contains fourteen chapters, each imparting a succinct view of the various needs of the Southern people from 1865 to the present time.

PSYCHOLOGIE DES GRANDS CALCULATEURS ET JOUEURS D'ÉCHECS. Par ALFRED BINET. (Psychology of Great Calculators and Chess-players. By Alfred Binet.) Paris: Librairie Hachette et Cie. 1894.

THE author of this work has made his investigations in these unusual forms of memory with the fundamental desire to discover something that might be utilized in pedagogics. The investigation of the mental processes of mathematical prodigies was made at the suggestion of the late Prof. Charcot. The investigation of chess-players' memories was made at the suggestion of M. Taine.

Mathematical prodigies form a natural class, and their ability is independent of heredity or environment. They manifest their talents precociously, and the familiarity with figures is at the expense of general intelligence. Furthermore, their aptitude is developed by exercise and is decreased by non-usage. It is largely a matter of auditory and visual mnemonics.

In blindfold chess the ability depends upon knowledge, memory, and imagination. The ability to recall so complex a mental image as one or more chessboards containing thirty-two or less pieces, in a variety of positions, constitutes what Binet designates as a visual geometrical memory, associated with which is a memory of recapitulation or faculty of repeating all the moves in the order in which they were played.

The work is an interesting study of curious phases of mentality.

THE PYGMIES. By A. DE QUATREFAGES. New York: D. Appleton & Co. (The Anthropological Series.) Pp. 255. Price, $1.75.

THIS work of one of the most eminent anthropologists of the century, translated by Prof. Frederick Starr expressly for the Anthropological Series, relates to a race, or rather a group of races, of men, concerning which speculation and tradition were rife for many centuries, but of which little or nothing was definitely known till very recently. They were mentioned by Homer, they were described by Aristotle, and were referred to as a historical fact by Herodotus. These authors placed them in Africa. Pliny, a more recent writer than they, speaks of them as living in different countries. The African pygmies remained substantially unknown, except from these ancient references, until a few years ago explorers of the heart of Africa brought home accounts given of them by neighboring tribes. Schweinfurth saw them and obtained an individual Akka, and specimens were brought to Europe; since then acquaintance has been direct. Besides these, M. de Quatrefages classified with the pygmies other "small black races" which had attracted his attention and interest in a special manner, and made frequent references to them in his writings. "These little blacks," he says, "are to-day almost everywhere scattered, separated, and often hunted by races larger and stronger; nevertheless, they have had in the past their time of prosperity," and have played a very real ethnological part. The principal purpose of this book is to make known the scientific truth in regard to the ancient fables, and to show what the pygmies of antiquity really were. He finds that the ancients had information "more or less inexact, more or less incomplete, but also more or less true," concerning five populations of little stature from whom they made their pygmies. Two were located in Asia; a third to the south, toward the sources of the Nile;

a fourth to the east, not far from these; and the fifth in Africa, to the southwest. Two of these groups, more or less modified by crossing, are still located in Asia. The African groups are farther away than the traditions represent, but nearly in the same direction. All of them are fragments of two human races well characterized as blacks, occupying considerable areas in Africa and in Asia respectively, and both including tribes, distinct peoples, and subraces. The name of *Negritos* is suggested for the dwarf black populations of Asia, Malaysia, and Melanesia, as distinguished from the larger negroes, or *Papuans*, and *Negrillos* for the dwarf African tribes, taken collectively. These definitions and distinctions having been made clear, the author proceeds to detail the general history of the eastern pygmies, of whom the Mincopies of the Andaman Islands appear a conspicuous type, their physical and special characteristics, and of other negroes than the Mincopies; and next of the Negrillos, or pygmies of Africa; closing with a discussion of the religion of the Hottentots and Bushmen. The conclusion is drawn from the study of the Negritos, which have been regarded as very low in the scale of humanity, and by some as related to the "missing link," that "this is not so; and that where they have lived most outside of movement and mixture—which alone elevate societies—the Negritos show themselves true men in all things and for all things."

ECONOMIC GEOLOGY OF THE UNITED STATES. By RALPH S. TARR, B. S., F. G. S. A. New York: Macmillan & Co. Pp. 509. Price, $4.

IN the presentation of this text-book on economic geology the author has extended his primary plan from the issuance of printed notes to accompany a series of lectures delivered before the Economic Geological Class at Cornell University. Hence, a far wider field is destined for a work which will necessarily take the place of books that treat too exclusively of those branches of the subject having little or least importance for more thorough students.

Throughout the volume the reader's attention is directed to the mineral products of the United States, while only those of special importance from foreign localities are dealt with. Apart from the ample reports of State and national geologic surveys, the author has consulted and employs with effect special articles and data selected from leading scientific journals of the day. Also Ore Deposits, by Phillips, the Reports of the Director of the Mint, Day's Mineral Resources of the United States, the Census Reports, Mineral Industries, etc. Tables and illustrations add to the usefulness of the work.

ABOUT MUSHROOMS. THE STUDY OF ESCULENT AND POISONOUS FUNGI. By JULIUS A. PALMER, Jr. Boston: Lee & Shepard. Pp. 100. Price, $2.

THIS is a pleasant little book, that will interest both the amateur and the trained naturalist. The classification, or key to the principal forms of large and fleshy fungi, is original with the author, and promises to facilitate the work of those commencing the study of the subject.

SYSTEMATIC SURVEY OF THE ORGANIC COLORING MATTERS. By Drs. G. SCHULTZ and P. JULIUS. Translated and edited by ARTHUR G. GREEN, F. I. C., F. C. S. New York: Macmillan & Co. Pp. 205. Price, $5.

A THOROUGH knowledge of the chemistry and technology of coal-tar products has within recent years become a necessity with those engaged in the color industry.

The work before us is a technical one, and appears to be thoroughly well suited to the needs of the analyst, the dyer, patent agent, merchant, or others concerned with coal-tar colors.

The editor and translator has carried out the fundamental idea of the authors, and has given us, in as precise a form as possible, all the essential details, including items of the most recent knowledge. There have also been added full tables for the analysis and identification of the various coloring materials.

The *Report on the Mound Explorations of the Bureau of Ethnology*, an extract from the twelfth annual report of the bureau, by *Cyrus Thomas*, is based almost exclusively upon the results of explorations carried on by the bureau since 1881. A thorough investigation of all the mounds could not be made with the means at the disposal of the bureau; a superficial examination was not to

be thought of. The problem was solved by making thorough examinations of single mounds and single groups, selecting such as were most typical, over the whole area; so that, by a careful examination of these typical structures in the various districts, the end, it was thought, might be secured of collecting the data necessary to an understanding of the more general and more important problems relating to the mounds and the mound-builders. The exhaustive examination of many single groups and the study of local problems are left to the future. Accurate and full descriptions and measurements are given of all the mounds and groups examined. The collections made include pottery of most of the known varieties, and some that are new, showing most of the known types of textile impressions and some that are unusual; polished and pecked celts from mounds; stone pipes, which so supplement others that the whole evolution of forms may be traced from the earliest known; copper articles, including two new types, "decidedly the most important yet discovered"; engraved shells; specimens of textile fabrics and mattings; and chipped flint implements, stone axes, discoidal stones, gorgets, etc. (Published at the Government Printing Office, Washington.)

In the preparation of his *Elements of Mechanical Drawing* the author, *Gardner C. Anthony*, has aimed, as in the other numbers of his Technical Drawing Series, to provide a text-book rather than a copy-book, a treatise in which principles should be established and methods suggested, but freedom permitted in their application. It is intended that the student should first thoroughly master the principles, and then, unaided, apply them to the solution of the problems, receiving such instruction as his special case may demand. The system has been successfully applied by the author and others in teaching various classes. The present work concerns geometrical problems, conic sections, projection, the development of surfaces, the intersection of surfaces, screw threads and bolt heads, bolts, and isometric and oblique projection. (Published by D. C. Heath & Co., Boston. Price, $1.50.)

In *The Natural History of Hell*, a discussion of some of the relations of the Christian plan of salvation to modern science, including a chapter on miracles and a scientific examination of the theory of endless punishment, *John Phillipson* undertakes a scientific demonstration of the natural necessity of endless punishment for wrongdoing, inevitable unless arrested by some agency outside of Nature. The argument is based upon the conception of the never-ending endurance and transmission of the picture and the consequences of every action. Under this view there is a necessity for some plan of salvation outside of natural law. Here science stops. (Published by the Industrial Publication Company, New York. Price, 25 cents.)

Expositions of Buddhism have come to us in two works. Of *The Gospel of Buddha*, according to the old records, by *Dr. Paul Carus* (Open Court Publishing Company, Chicago), the bulk of the contents is derived from the old Buddhist canon. Many passages, including the most important ones, are literally copied from translations of the original texts, rendered rather freely in some cases to make them intelligible to the present generation; others have been rearranged; and still others are abbreviated. The few original additions embody ideas for which prototypes may be found somewhere among the traditions of Buddhism, and are given as elucidations of the main principles of the doctrine. For those who want to trace the Buddhism of the book to its foundation a table of references is appended, directing to the sources of the various chapters and pointing out parallelisms with western thought.

A Buddhist Catechism (G. P. Putnam's Sons) is an introduction to the teachings of the Buddha Gotamo, compiled from the holy writings of the southern Buddhists, with explanatory notes for the use of Europeans, by *Subhadra Bhikshu*. It is a concise representation of Buddhism, according to the Ceylonese Pali manuscripts of the Tipitakam, which are regarded as the oldest and most authentic sources. It contains the fundamental outlines of the doctrine, with the omission of the legendary, mystic, and occult accessories with which Buddha's teachings have been adorned or encumbered in the course of centuries.

The third part of the *Elementary Treatise on Theoretical Mechanics* of *Alexander Ziwet* (Macmillan & Co., $2.25) is on kinetics. About half of the volume is devoted to the

kinetics of a particle, and the remainder is given to the study of the kinetics of a rigid body and a brief discussion of the fundamental principles of the kinetics of a system. In the discussion of the motion of a particle (impact, rectilinear motion) such fundamental ideas as momentum, impulse, kinetic energy, force, work, potential energy, and power are gradually introduced and illustrated in an elementary way. Then the general equations of motion of a particle are discussed; and the principle of kinetic energy, that of angular momentum, and the principle of d'Alembert are explained and applied—first, to the motion of a free particle, then to constrained motion. In treating of the motion of a rigid body, after the discussion of the fundamental principles and of the theory of moments and ellipsoids of inertia, the action of impulses and the motion under continuous forces are taken up separately. The last chapter, on the motion of a system, is brief, but includes the theory of Lagrange's generalized co-ordinates and of Hamilton's principle.

A suggestive and useful little book prepared by *William C. Connell*, and published by G. P. Putnam's Sons, is *The Currency and the Banking Laws of the Dominion of Canada, considered with Reference to Currency Reform in the United States.* It contains the substance of an address delivered at the American Bankers' Convention held at New Orleans in 1891, in which financial straits that have since occurred were predicted; followed by the Banking Act of Canada, given entire. This act is presented as completely filling all the requirements of the community in which it exists and flourishes, and worthy of consideration in reconstructing our own financial system.

The Dynamics of Life (Blakiston & Son, Philadelphia) presents the substance of an address delivered before the Medical Society of Manchester, England, in October, 1894, by W. R. Gowers, M. D. In it are explained, without the author assuming any claims for novelty in conception, the operations of Latent Chemical Energy, the Dynamics of Muscle, the Dynamics of Nerve, and the Dynamics of Disease. Summing up the results of his inquiry, the author observes that, search as earnestly and thoroughly as we may, that which we call life eludes our search and resists our efforts. "We may, indeed, trace the relations to vitality of matter and of the energy it bears—their entrance into the domain of life, their exit, their effects." But we see them only as shadows in the mist.

In the *Fifth Annual Report of the Missouri Botanical Garden*, for 1893, mention is made of the destructive effects of drought and extreme alternations of winter temperature on the lawns and the evergreens. The Norway spruce has particularly suffered, and it will be only a few years before all the older trees will have disappeared. The old red cedars and the arbor vitæs are also succumbing, and are being gradually removed. A similar experience is recorded at the Harvard Botanic Garden. The year's additions to the herbarium number 19,417 sheets. In addition to the "Shaw Premiums" already awarded annually, a gold medal has been instituted for the introduction of a plant of decided merit for cultivation not previously an article of North American commerce. The Garden and the School of Botany, endowed by Mr. Shaw in Washington University, are working harmoniously together. The volume, including the report, contains the usual anniversary publications and scientific papers on the Venation of Salix, by Dr. N. M. Glatfelter; the Tannoids, by J. C. Beny; the Sugar Maples, by Dr. Trelease; Gayophytum and Boisduvalia, by Dr. Trelease; Pomological Notes for 1892 and 1893, by J. C. Whitten; The Emergence of Pronuba from Yucca Capsules, by J. C. Whitten; Plants collected in Southeastern Missouri, by B. F. Bush; Notes and Observations, by Dr. Trelease; and more than forty plates.

The first of the two volumes of *Lord Rayleigh's* work on *The Theory of Sound*, first issued in 1877, has come to a second edition (Macmillan, $4). The work is a mathematical presentation of the subject, aiming to include the more important of the advances made in modern times by mathematicians and physicists. The present volume includes chapters on the vibrations of systems in general, followed by a more detailed consideration of special systems, such as stretched strings, bars, membranes, and plates. In the second edition are two new chapters, dealing respectively with curved plates or shells and with electrical vibrations. Minor changes and new sections are inserted

here and there. The author remarks that the mathematician will complain of deficient rigor in his method of treatment, but he feels that from the point of view of the physicist some slight relaxation is justifiable.

A text-book on *Steam and the Marine Steam Engine* has been prepared by *John Yeo*, R. N., from notes of the lectures given by him as an instructor in steam engineering at the English Royal Naval College (Macmillan, $2.50). The scope of the book includes descriptions of the marine boilers and engines in common use, with their fittings, a statement of the properties of steam, and instruction concerning feed-water, the combustion of fuel, etc. Other matters treated are the construction of double and triple expansion engines and the form of propeller screws. The author's language is notably clear and concise, and the volume is fully illustrated.

Under the title *The Genesis of Water* a speculation as to how the first combination of oxygen and hydrogen took place is presented by *P. W. Dooner*. The pamphlet is printed at Los Angeles.

In the *Report of the State Board of Health* of South Dakota for 1892 we find, besides the usual accounts of the transactions of the board and the conditions of public health, articles for public information on Dangerous Contagious Diseases and Diphtheria, and more general articles on climate and the climatic cure for consumptives. The climate of South Dakota is presented as of special value, from the medical point of view, on account of the peculiar dryness of the atmosphere. "That it is as good as any during the summer is not to be doubted, and that in winter it is far better than the great majority is a fact." Cases of "taking cold" and of pneumonia are much rarer in proportion to the population than in the States farther east; and with the clearness of the atmosphere of the country and its lack of clouds and cloudy weather the sunlight acts as an efficient tonic and destroyer of impurities. The claim is maintained that the climate fulfills to an excellent degree the conditions of one favorable to consumptives.

A new educational journal, devoted to "manu-mental" training, has appeared under the title *Art Education* (J. C. Witter & Co., 853 Broadway, New York; 75 cents a year). It is to be issued bimonthly for the present. Its field is the training of the mind through the use of the hand, and hence comprises drawing, manual training (so called), and writing. In the first number are articles by Francis W. Parker, on Acquiring Forms of Thought Expression; Stella Skinner, on Color Study; Henry T. Bailey, on the Supervisor of Drawing; besides quite a number of biographical notices, with portraits of instructors in drawing, manual training, etc. There is a colored supplement, which it is small praise to say is worth the price of the number. It consists of two lithographic figures printed in several shades of brown, and "illustrates the fact that artistic effect does not depend so much upon an elaborate design as upon correct combination of color." The editors are James C. Witter, Charles P. Zaner, and Rose N. Yawger.

A Stable Money Standard is the title of the address by *Henry Farquhar*, Sectional Vice President, before the Section of Economic Science and Statistics, of the recent Brooklyn meeting of the American Association. The author concludes that while gold has been proved by the experience of the ages to be the best-fitted medium to meet the requirements of such a standard, all interference by Government in defining legal tender is needless and mischievous. Perfect freedom in contracts for methods of payment and for the kind of money should be allowed, the terms of the contract to be interpreted and enforced according to prevalent usage; the Government's part being only to certify to the weight and fineness of its coin.

The Twelfth Annual Report of the Board of Control of the New York Agricultural Experiment Station includes the report of the treasurer, showing the receipts and expenditures on the several accounts, and the reports of the director describing the additions and improvements that have been made to the station and its appurtenances and the work done. Fifteen bulletins were published, containing six hundred and ninety-five pages in all, of each of which fifteen thousand copies were distributed; besides circulars on the Leaf Spot of Chrysanthemums, Preserving Eggs, and the Fertilizer Law of the State. The new experiments undertaken include investigations with a view to determine the relative value of the different breeds of

dairy cattle in the production of milk, butter, and cheese, and of the differences in composition and quality of the milk produced; experiments with poultry and in feeding swine; chemical experiments, mostly bearing on the manufacture and qualities of cheese; and experiments with vegetables, various fruits, diseases of fruits and fruit trees, celery diseases, and potato scab.

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POPULAR MISCELLANY.

Doggish Sympathy.—A correspondent of the London Spectator writes that he owned a large dog Rose, and a smaller and less beautiful dog Fan, of different breeds, but both passionately attached to a member of the household who was commonly called their best friend. A shawl of this friend's was especially sacred to Fan, and jealously watched, especially as against Rose; and when the best friend was in bed Fan would lie in her arms, opposing with growls the approach of all intruders. One day Rose in jumping over a gate spiked herself badly and was committed to surgical treatment for ten days. "On her return she was cordially welcomed by Fan and myself; but when she rushed upstairs to the room of her best friend (then confined to her bed), my mind foreboded mischief. We followed, and I opened the door. With one bound Rose rushed into her best friend's arms, taking Fan's very own place, and was lost in a rapture of licking and being caressed. Fan flew after her, but, to my amazement, instead of the fury I expected, it was to join in heart and tongue with the licking and caressing. She licked Rose as if she had been a long-lost puppy instead of an intruder; and then, of her own accord, turned away, leaving Rose in possession, and took up a distant place on the foot of the bed, appealing to me with almost a human expression of mingled feelings—the heroic self-abnegation of newborn sympathy struggling with natural jealousy. The better feelings triumphed (not, of course, unsupported by human recognition and applause) till both dogs fell asleep in their strangely reversed positions. After this, there was a slight temporary failure in Fan's perhaps overstrained self-conquest; but on the next day but one she actually, for the first (and last) time in her life, made Rose welcome to a place beside her on the sacred shawl, where again they slept side by side like sisters. This, however, was the last gleam of the special sympathy called forth by Rose's troubles. From that day Fan decidedly and finally resumed her jealous occupation and guardianship of all sacred places and things, and maintained it energetically to her life's end."

Protoplasm for Hot Stars.—A new subject for speculation has been suggested by Sir Robert Ball's observation that life on the heavenly bodies materially hotter or colder than the earth, or differing in other important respects, is exceedingly improbable if not impossible for beings of the forms and composition which we associate with life. But is protoplasm composed of carbon, hydrogen, oxygen, nitrogen, and a little sulphur the only physical basis on which life can exist? May there not be protoplasms of other compositions adapted to hot stars or to cold stars, upon which life as vigorous as that upon the earth may exist on such bodies? Prof. Emerson remarked two or three years ago that silicon, when the earth was in an intensely hot stage, played much the same part that carbon does now; and that under the conditions then prevailing the silicon compounds, now immobile, may have been active.

In those days, when the temperatures were above the point of decomposition of many of the carbon-nitrogen compounds, a silicon-aluminum series may have presented cycles of complicated syntheses, decompositions, and oxidations essentially parallel to those that underlie our own vital phenomena. The case is at least fascinatingly plausible. If we are to admit the possibility that the chemical accompaniments of life were rehearsed long ago and at far higher temperatures by elements now inert, it is not such a very long step from this, an English essayist suggests, to the supposition that vital, subconscious, and conscious developments may have accompanied such a rehearsal. One is startled toward fantastic imaginings by such a suggestion: Why not silicon-aluminum men at once—wandering through an atmosphere of gaseous sulphur, let us say, by the shores of a sea of liquid iron some thousand degrees or so above the temperature of a blast furnace? But that, of course, is merely a dream. Who will discover a silicon-aluminum fossil?

A Study of Maya Hieroglyphics.—American students have not made as much progress in Central American archæology as those of Europe; and it is only recently that the Peabody Museum of Harvard University has undertaken to carry on extensive and exhaustive researches in what Mr. Marshall H. Saville styles the most prolific source of hieroglyphic inscriptions of which we have knowledge. The ancient inhabitants of Copan, Honduras, Mr. Saville says, in his his paper read before the American Association, appear to have been more literary in character than even those of Palenque. There have been found there twenty-four stelæ, all of which have inscriptions, besides altars, slabs, and hieroglyphic steps in large numbers. Pottery vessels and potsherds have been found bearing glyphs, either painted or engraved. These potsherds have been found in such quantities as to show that thousands of their vessels had hieroglyphic inscriptions. The inscriptions are intimately connected with the symbolism almost invariably found with them, and an understanding of the symbolic marks and ornaments will largely aid in deciphering the glyphs. One glyph is found so often repeated on the potsherds as to become significant, and this is the special subject of the author's present study. It is at the head of most of the graven inscriptions of Copan, Palenque, Quirigua, Jikul, and Menche, and of the three tablets of Palenque, and is named by the author the Pax glyph. The heading indicated by this glyph is found on analysis to represent the month Pax, surmounted either by a serpent's head, a mask, or a human face, associated with a vegetal form, or rarely a fish, above the whole of which is a scroll. Having in view the ideas and the nature of the festivals associated with this month, the author concludes that the inscriptions beginning with this heading relate to ceremonies taking place at that time to the god Kukulcan. The occurrence of the Pax glyph in the text, with the hand sowing seed, and again with a flower with seeds, also bears out this conclusion, and it may be inferred that the inscriptions, so far as these single glyphs are concerned, relate to the ceremonies of planting.

Chinese Ideas of War.—M. Léon de Remy has made a curious communication respecting the ideas of the Chinese concerning war. Although it has often been necessary for the Chinese to engage in war, the military art has never been in good repute among them. In their view, every war is a misfortune, if not a sin. They avoid talking to their children of laurels, crowns, and triumphs won in war, but teach in their schools that the most glorious battles are at bottom simply homicides, abominable disasters to both parties. An emperor who decides to sacrifice numerous existences on a field of slaughter is reputed an unwise and unjust prince. A general who has won a battle ought to wear mourning for the quantity of blood his success has cost. These doctrines are not gross or immoral, but in the existing conditions of society generous thoughts are not without some inconveniences; and it is easy to understand how, with such ideas concerning war, the Middle Kingdom has been conquered sometimes by peoples of no great importance and not very well armed. Nevertheless, it is a curious ethnographical fact that whenever the Chinese people have been conquered they have absorbed their conquerors to their almost entire disappearance.

The successors of the Manchu conquerors are now reigning in China, and it can hardly be said that any Manchus exist in Asia. Those who serve are treated at the court like slaves, while the powers are very careful not to show any lack of respect to the Chinese. The Manchu language, in spite of efforts to give it some literary and political importance, has been thrown into the background, and is hardly more than one of the rude jargons of central Asia.

The Baskets of Lichtenfels.—One of the largest basket markets in the world is situated in the little town of Lichtenfels, in the mountains of upper Franconia, Bavaria. The industry was introduced there toward the close of the last century by a citizen who, desiring to take advantage of the fine growth of willow trees in the neighboring valley of the chain, began weaving baskets on a small scale corresponding with his means. The business gradually developed in extent and in variety and artistic character of the designs; the products were sent to the larger markets, and even France was almost exclusively supplied from Lichtenfels till the war of 1870, and is still supplied thence to a considerable extent. The gradually increasing demands soon made it necessary to procure foreign raw material. The finer varieties of willow reeds had to be imported from Hungary and France and from countries beyond the sea. Straw for the finer woven articles was ordered from Spain and Italy, and the palm leaves used for ornamenting the better class of wares from the tropics. In this manner the evolution of the house industry, as it is called, of Lichtenfels proceeded, and has resulted in the employment at this time of about sixteen thousand men, women, and children, who produce every variety of basket from the simplest to the most elegant. Factories, as usually spoken of, are few. The manufacturer delivers the raw material to the people who are to make the baskets at their own home—that is, he weighs out for them the willow reeds, colored straw, palm leaves, etc., and gives them the designs according to which they are to be made, and at a stated time the workers—who mostly live in neighboring villages—bring their work to the manufacturer and receive their pay. The industry is encouraged through the schools of design that have been established and are supported by the state, in which the young people of the neighborhood are educated in all branches of it.

Fjords, Fjörds, and Fohrden.—Fjords according to a memoir by Herr P. Dinse, of Berlin, are long, narrow bays or sea inlets, penetrating an elevated or mountainous coast; their sides slope steeply both above and below water, giving a troughlike cross-section, while the longitudinal section shows an irregular relief of gentle ridges and shallow troughs. In all true fjords the depth inside is greater than that of the stretch of sea immediately beyond the mouth. There are several varieties of this type. Thus, two fjords entering the coast at an angle may meet, forming a sound separating an island. Again, the bar of the mouth may be slightly elevated so as to become dry land, and a fjord lake or loch results. Minor subdivisions include the fjärd and schären types by the Gulf of Bothnia, differing only in the relative frequency of islands and continuous coast and the föhrden type of the low coasts of Denmark. These are entirely different from the inlets of the *ria* type, which occur on the coasts of Spain, northwestern Ireland, and elsewhere. A *ria* is a more or less wedge-shaped inlet, gradually widening and uniformly deepening from its head to the sea, showing no trace of an included basin. It is noted, however, that prolonged sedimentation might ultimately convert a fjord into a *ria*. The distribution of fjords as distinguished from *rias* is subject to the general statement that there are no fjords except on the coasts of lands which show signs of recent glacial action. The coasts where they occur are those of Scandinavia, the west of Scotland, northwest of Ireland, Iceland, Greenland, Labrador, and the coast of Maine, the west coast of North America from Alaska to Vancouver Island, the west coast of South America from Chiloe to Cape Horn, Kerguelen, the antarctic lands, and the southern part of the west coast of the South Island in New Zealand.

Cave Exploration.—Spelæology is the name given by M. E. A. Martel to the study of caves—a study which he regards as of much greater significance than has hitherto

been attached to it. He believes that it may be made to throw light on all the branches of science that deal with the structure of the earth—on geography, geology, paleontology, mineralogy, zoölogy, anthropology, the physics of the globe, agriculture, public works, and hygiene. In his explorations of caves M. Martel has devoted much attention to those openings which form a peculiar feature in the limestone regions of France and eastern Europe, called *gouffres* or pits, which have been regarded hitherto chiefly as curiosities or feeders of superstitious fears, but are almost virgin to scientific exploration. During six years, from 1888 to 1893, he explored two hundred and thirty of these *gouffres* and other cavities, one hundred and sixty-five of which had never been examined before, and made a large number of plans. In this work he had special regard to the hydrology, the origin, location, etc., of subterranean waters, with a view to utilize the lessons of his observations in agriculture, but did not neglect to examine carefully all the other bearings, not letting the most minute features pass unobserved. The results of his investigations have been published in a book, *Les Abîmes*.

Forests and Climate.—Considering the Relation of Forests to Climate and Health, Cleveland Abbe finds that while the forest does not cause increase of rainfall, its tendency is to conserve it. The forest shields the moisture from evaporation and uses less of it for its own growth than would be used for the growth of grasses or herbs, and it also conserves what is left in the soil so as to diminish, or at least regulate, the drainage into the river basins, thereby reducing the danger of destructive floods. The influence of forests extends outside of their boundaries under varying conditions. The effect of forest-covered mountains is to diminish the cold night winds and the hot day breezes in the valleys below, and to favor the formation of local cloud and rain in them. As the air that flows down the mountain side during the night from a forest has a higher dew point and a lower temperature than that which flows down from an unforested surface, therefore a less amount of cooling will cause it to form fog; hence the crops in the valley are more likely to be sheltered by the fog from dangerous frosts. The most interesting influence of the forest on the leeward side is that which it exerts by virtue of its action as a wind-break. A diminished wind means that the sluggish moving air shall be warmed up in the daytime by contact with the ground much more than would be the swift-moving air when the wind-break is absent. This reacts upon the ground, so that as a consequence both soil and air are warmer. The evaporation from the surface of the soil is also greatly diminished, in consequence of which the soil retains more moisture, and is warmer than it would be under the influence of a strong wind. At the same time, the air above the soil acquires a higher percentage of relative humidity. Thus the plant has more water at its disposal stored in the earth, while the leaves, apparently, are in less need of water, and transpire less.

Biological Laboratory at Cold Spring.—The Biological Laboratory of the Brooklyn Institute at Cold Spring Harbor, L. I., aims first at instruction. Each year a course has been given there in elementary systematic zoölogy, adapted both to teachers whose knowledge of elementary zoölogy is not great, and to students of higher institutes who seek a practical study of marine forms. A botanical department was organized in 1893. More advanced courses have been established, and lessons were given last summer on comparative embryology. A course in bacteriology is given by the director. Original investigation is provided for in private rooms for research, and most of the Board of Instruction and others who have been present from time to time have been engaged in personal work in that line. In addition to the regular work of the school, evening semi-popular lectures are given to the students and to attendants from the neighborhood. During the last year a department was started for supplying specimens of the common types of marine life to colleges and schools.

Lord Rayleigh on Waves.—In a lecture at the Royal Institution, on waves of water, Lord Rayleigh said that in such waves the velocity is not independent of the wave length (or distance from crest to crest) as it is in the case of sound waves, but the long waves

travel more speedily than the short ones. Waves at sea are mostly generated by wind, though other causes, such as earthquakes, occasionally operate. By blowing the surface of a long trough with a fan, the lecturer showed that the waves produced close to the source of the wind are shorter than those set up farther away. Oil has no effect upon big rollers, but the broken water on which it acts is just what is dangerous to boats in a tempest. A storm in mid-ocean generates waves of all lengths, but a kind of regularity is reached at a distance, where the long waves arrive first. The height of waves at sea has often been exaggerated, owing to the difficulty of measuring them, but the highest authentic observation is about forty feet. Stationary waves, as opposed to the progressive waves of which the lecturer had been speaking, were described as the results of the meeting of two equal sets of progressive waves. In illustration of the effects of waves upon ships, Lord Rayleigh showed a small model boat so weighted as to have the same rolling period as the waves in the tank in which it floated. Its rolling was exceedingly violent, but became comparatively slight when the heights were altered so as to change the rolling period. Warships, in which stability is very essential, are designed so as to have a longer period of roll than any waves they are likely to encounter.

Plymouth School of Applied Ethics.—The School of Applied Ethics at Plymouth, Mass, has had three profitable sessions—in 1891, 1892, and 1894; the session of 1893 having been omitted on account of the congresses at Chicago. At the first session, 1891, H. C. Adams, dean, the faculty numbered twenty-nine, and one hundred and sixteen lectures were given in the three departments of Economics, Ethics, and History of Religions. At the second session, Prof. C. H. Toy, dean, there were twenty-two lecturers and ninety-six lectures, in the three departments as before. At this session the Wednesdays were set apart for conferences and other special meetings—an experiment which was regarded favorably, but was not repeated during the next year. At the third session, 1894, Prof. Felix Adler, dean, there were thirty lecturers and one hundred and one lectures. The general subject in each of the three departments was the labor question, which was treated from various points of view, some of the lecturers being among the foremost political economists of our leading colleges and universities. The fourth session will begin in the second week in July, 1895, and will continue five weeks. An "Auxiliary Society of the School of Applied Ethics" has been formed, for the purpose, among others, of making the school and its work more widely known. Membership is open to all, for five dollars a year, and applications for it may be sent to the Rev. Paul R. Frothingham, New Bedford, Mass.

Indian Bows, Arrows, and Quivers.—In an interesting study of North American Bows, Arrows, and Quivers, published in the Smithsonian Report for 1893, Prof. Otis T. Mason shows how, in respect to either and all these appurtenances of the savage warrior and hunter, the form and material of the instrument and the manner of making it vary with and are dependent upon the kind of material which the local manufacturer had at his disposal. The bow is of hard wood, and simple, but of various forms according to fancy, in those regions where strong, elastic woods are abundant; compound, built up of buffalo or other horns in several pieces skillfully joined, where wood is scarce and the other material plenty; sinew-lined—finely shredded sinew mixed with glue being laid upon it so as to resemble bark—in the regions of the Sierras and as far north as the headwaters of the Mackenzie; sinew-corded, or having a long string or braid of sinew passing to and fro along the back, of which several types are found in the arctic and subarctic regions. The material of bows varies geographically, and the list shows that in some regions some of the apparently most unpromising woods are used in their construction. The strings are of rawhide, the best vegetable fibers of the country, the intestines of animals cut into strings and twisted, or, most frequently, of sinew. The study is continued, with even more minutenes corresponding with the varieties of detail involved —concerning the head, the shaft, nocking, notching, and feathering—with the arrow. The quiver is difficult of study, because collectors have paid little attention to it. Among all the Plains tribes the quivers are

objects of beauty. The quiver is largely of the region. The material out of which each example is made must be furnished by Nature: hence it is of sealskin in one place, of cedar wood in another, of soft pelt in another, and in the south land is frequently made of some kind of soft basketry. "Among several of the mountain tribes the squaw lavished all her skill upon her husband's quiver. The costliest beaver, marten, otter, and mountain-lion pelt was invoked. It was lined with soft buckskin, or in after times with red stroud-ing. Beads of every imaginable color were worked upon the border of the arrow case and upon the lining of the long pendant therefrom. Strips of fur, daintily cut in fringes, were sewed about the bottom of the bow case, and every spot capable of rich decoration received it. Between this and the plain salmon-skin capsules into which the Eskimo thrust his arrows there are many gradations of quivers."

Prof. Sergi's Human Classifications.—In studying the varieties of the human species, Prof. Giuseppe Sergi, as he is quoted in a paper by Dr. D. G. Brinton, finds that hybridism is a syncretism or propinquity of characteristics belonging to many varieties; that these do not modify the skeletal forms as do individual variations; and that hybridism may affect different parts of the skeleton, constituting characteristics in themselves distinct. The stature, the thoracic form, the proportion of the long bones may be united with external characteristics differing from each other, as well as from different cranial structures. The cranial form may be associated with different facial forms, and inversely. It happens, however, that the structures taken separately remain in part unvaried in the hybrid constitution. The face preserves its own characteristics in spite of the union of different cranial forms; so also the cranium preserves its structures, associating them with different facial forms. The stature preserves its own proportions in spite of its association with different cranial and facial types, and in spite of the different coloration of the skin and form and color of the hair. All this may be affirmed, particularly of much larger human groups which, according to external characteristics, may be considered much nearer than they really are in geographical position, as the so-called white races in Europe, the negroes in Africa, in Melanesia, and so on. Seeking a criterion of classification, the author finds that external characteristics can not be relied upon. Regarding the internal or skeletal characteristics as presenting greater stability, he chooses the cranium, as at the same time the most important and most useful. He thus impliedly accepts the brain in its various forms. He finds sixteen varieties of the human species, without considering that he has exhausted the number, and fifty-one subvarieties.

A Monkey's Caprices.—The last of the famous group of pets which Frank Buckland collected at his house died January 17th. It was the monkey, Tiny the second, of the species *Cercopithecus mona*. She was a beautiful and graceful creature, covered with a thick coat of handsomely shaded hair, and had been under Mrs. Buckland's care seventeen years and a half. She had the life-long reputation of being exceedingly mischievous, and was an accomplished thief. She led a gray parrot, which had been an inhabitant of the house for twenty-five years, a terrible life; and when she was let out of her cage she played havoc with her master's papers and manuscripts. She would dash about the room, make a clean sweep of the table, and fill her pouches with anything that appeared especially nice. Her two later companions were a gray parrot and a thoroughbred dachshund, Olga. Every morning Tiny and the dog had a game of romps that invariably ended in the discomfiture of Olga. The dog would run round the monkey's cage, barking loudly; Tiny, inside the wires, would run round also, and when opportunity occurred would seize the dog's ears and keep pulling at them till Olga released herself. Notwithstanding these little disagreements, the dachshund appeared to miss Tiny, and went about the house as if seeking her. The parrot, too, seemed to regret the loss of the monkey, and efforts were made to cheer her drooping spirits, if possible.

Qualities of the Acetylene Light.—The method of producing acetylene, one of the most brilliant constituents of illuminating

gas, by the simple action of water on calcium carbide has been mentioned in the Monthly. Great possibilities from the use of this method are foreshadowed by Prof. Vivian B. Lewes. The property possessed by calcic carbide of forming acetylene with water was accidentally discovered while working with the electric furnace to form an alloy of calcium. A mixture containing lime and powdered anthracite was fused down to a semi-metallic mass, which, proving not to be desired, was thrown into a bucket containing water, when a rapid effervescence took place, and the escaping gas burned, on the application of a light, with a smoky but luminous flame. This source of light can be produced by the exposure to the electric furnace of finely ground chalk or lime mixed with powdered carbon in any form. When the calcic carbide is placed in a glass flask and water is allowed slowly to drip upon it from a dropping tube, the decomposition begins at once with considerable rapidity, and the acetylene pours off in a continuous stream; as the decomposition continues, the solid mass in the flask swells up and is eventually converted into a mass of slacked lime. The value of this useful product may be deducted in computing the cost of the acetylene. For commercial purposes the carbide may be cast direct from the electric furnace into rods or cylindrical cartridges, which, when twelve inches long and an inch and a quarter in diameter, will weigh one pound and will give five cubic feet of gas. Acetylene is a clear, colorless gas, with an intensely penetrating odor which somewhat resembles garlic. The strong smell is a great safeguard in its use, and, when the quantity of the gas is dangerous, can not be endured. Hence, while poisonous like carbon monoxide, its use, on account of its odor, is much more safe. When burned it emits a light greater than that given by any known gas, its illuminating power, calculated to a consumption of five cubic feet an hour, being two hundred and forty candles. It being liquefiable with comparative ease, enormous volumes of it may be compressed in small wrought-iron or steel cylinders, in which it may be stored and from them burned as wanted. It should not be used with silver or copper, as it forms explosive compounds with their ammoniacal solutions. Advantage may be taken of the calcic carbide method of forming acetylene by putting sticks of the carbide coated with a slowly soluble glaze into cylinders containing water and attached to portable lamps. As the glaze dissolves from the surface of the stick of carbide, acetylene is generated, and the five cubic feet furnished by the stick are compressed by their own pressure, so as to supply through a suitable burner a light of more than twenty candles for about ten hours. The most immediate use contemplated by Prof. Lewes for acetylene is for enriching ordinary illuminating gas.

Cycling and the Heart.—Dr. B. W. Richardson represents cycling as differing from other exercises in that it tells primarily and most distinctly upon the heart. It produces at once a quickened circulation, though the riders may not be conscious of it; and this accounts for the astonishing journeys a cyclist can undertake, and his endurance as against sleep. Although the heart increases in action and sometimes undergoes enlargement, the author has never seen a rider embarrassed by overstrain of it, faintness, breathlessness, angina, or vertigo, so as to oblige him to dismount. Indeed, he had known a practiced rider who could climb a hill on his machine, but could not mount a flight of stairs on his feet without breathlessness and a slight palpitation; he had never seen a sudden death from cycling. He had met with instances in which, after several years of cycling, there was evidence of heart disease, with general languor and inability to sustain fatigue if exercise were again tried on the machine; and, on the other hand, he had known examples in which even an octogenarian had kept up the exercise in a moderate degree apparently with benefit to the circulation. He had seen in some cases apparent benefit arising from cycling even where there was an indication of some disease affecting the circulation, and had known good to arise from it in cases of varicose veins and of fatty degeneration, and in conditions of anæmia. In other cases excessive cycling had been a definite cause of injury to the circulation. The author believes that cycling in moderation may be permitted and even recommended to persons with healthy hearts; that it is not necessary

to exclude it in all cases of heart disease, while it may be even useful where the action of the heart is feeble and signs of fatty degeneration are found; that, as the action of cycling tells directly upon the motion of the heart, the effect it produces on that organ is phenomenally and unexpectedly great compared with the work it gets out of it; that the ultimate action of severe cycling is to increase the size of the heart, to render it irritable and hypersensitive to motion; that the overdevelopment of the heart affects in turn the arterial resilience, modifies the natural blood pressure, and favors degenerative structural changes in the organs of the body generally; that in persons of timid and nervous natures the fear incidental to cycling is often creative of disturbance and palpitation of the heart, and should be taken account of; that, in giving advice, it is often more important to consider the peripheral conditions of the circulation than the central; that venous enlargement is often rather benefited than injured by cycling; and that straining to climb hills and meet head winds, excessive fatigue, and alcoholic stimulants should be avoided, and the proper number of meals of light, suitably selected food should not be neglected.

NOTES.

THE leaves of pine and fir trees are inflammable—in strong contrast with the leaves of deciduous trees, which can not be made to burn at all while green—because of the pitch they contain, which consists of fats and ethereal oils, and compared with which the proportion of water is small. When the leaves burn, the water is at once converted into steam, and causes the explosions, snapping, and spitting of fire for which burning coniferous trees are remarkable. Dry fir leaves, although they burn very rapidly, do not exhibit these explosions, because there is no water in them. The rending of tree trunks struck by lightning is in like manner supposed to be caused by the steam evolved from the sap suddenly heated by the electric force.

M. SACCADO, a botanist of some fame, computes the number of known species of plants to be 175,700, including 105,251 phanerogams, 2,819 ferns, 565 other vascular cryptogams, 4,609 mosses, 3,041 liverworts, 5,600 lichens, 39,603 fungi, and 12,178 algæ; and he guesses that the whole number of fungi is perhaps as much as 250,000, and that of other plants 135,000. It is proper to observe that the author is a specialist in fungi, and is therefore perhaps predisposed to make a liberal estimate of their number.

THE International Meteorological Committee, at its recent meeting in Upsala, Sweden, decided upon the publication of a cloud atlas, to be in English, French, and German.

THE educational conference of a week, held last summer at the Summer School of Applied Ethics, Plymouth, Mass., was so successful that it has been decided to transform it into a department of the school. The special direction of the department has been assigned to a committee of three experienced teachers, and the sessions will begin near the end of July and close about August 12th. This new department does not enter into competition directly with existing summer schools, for the aim is neither to give instruction in the school subjects nor in the theory, history, and art of education, but to consider education as a social force and its relation to other social forces.

THE Deseret professorship of geology in the University of Utah has been endowed, as we learn in a note from Dr. James E. Talmage, the incumbent of it, with sixty thousand dollars by the liberality of the Salt Lake Literary and Scientific Association—not by the city, as was stated in a recent note in the Monthly. The Literary and Scientific Association is a body incorporated for scientific pursuits which has existed for several years in Salt Lake City.

RECENT dispatches from Europe state that argon, the newly discovered element in the air, has been found by Prof. Ramsay in combination in a mineral containing the extremely rare elements yttrium and erbium; associated with it was another gas which under Prof. Crookes's spectroscope gave a spectrum identical with that of the hypothetical element helium, which has been found in the spectrum of the sun and of the aurora borealis, but, till this time, nowhere else. M. Berthelot has, by means of the electric spark, effected a combination of argon with benzene.

A NEW weed has become common and abundant through a large part of the central Southwestern States. It is described by J. C. Arthur, of Purdue University Agricultural Experiment Station, under the name of *Lactuca scariola*—wild or prickly lettuce—as an annual, related to the garden lettuce, but bearing prickles on parts of the leaf and stem, and blossoming in July and August. It has all the qualities needed to insure its survival—producing many seeds, feathered for wind-carriage and ready to grow, sprouting abundantly when cut, and tenacious in its root hold. It is of curious botanical interest as having, like the *silphium* or com-

pass plant, the property of twisting its stem leaves into a vertical position, with the edge directed north and south. It is one of two well-marked compass plants. It is not likely to be exterminated, and can at most be kept down by timely mowing and uprooting.

THE result of an inquiry by Dr. J. S. Cameron, of Huddersfield, England, into the conditions of the dwelling as affecting recovery from measles, points to the conclusion that fresh air provided by a through draught tends to produce recovery when measles has attacked the family; while overcrowding, dirt, and structural or other insanitary conditions assist in bringing about a fatal result.

OBITUARY NOTES.

DR. W. S. W. RUSCHENBERGER, President of the Philadelphia Academy of Natural Sciences from 1869 to 1891, and medical director, United States Navy, retired, died in Philadelphia, March 24th, aged eighty-eight years. He served in the navy from 1826 to 1869, and was successively fleet surgeon of the East India squadron, 1835–'37 and 1847–'50; the Pacific squadron, 1854–'57; and the Mediterranean squadron, 1860–'61. During the civil war he was surgeon at the Naval Hospital, Brooklyn, and there organized the laboratory for supplying the service with unadulterated drugs. He was President of the College of Physicians and Surgeons in Philadelphia, 1879–'83. His literary and scientific publications include Three Years in the Pacific (1834); A Voyage Around the World (1835–'37); Elements of Natural History (1850); A Lexicon of Terms used in Natural History (1850); A Notice of the Origin, Progress, and Present Condition of the Academy of Natural Sciences of Philadelphia (1852); Notes and Commentaries during Voyages to Brazil and China, 1848 (1854). He also contributed many papers to scientific journals; published articles on Naval Rank and Organization, and edited the American edition of Mrs. Somerville's Physical Geography.

SIR HENRY RAWLINSON, of much fame as a British general and statesman and of greater fame as the first decipherer of the cuneiform inscriptions, died in London, March 5th. He was born in 1810; went to Bombay as a military cadet of the East India Company in 1827; studied Oriental languages, and served as an interpreter. In 1833 he was transferred to Persia, whence he was recalled to India on the breaking out of the Afghan difficulty in 1838–'39, and there won distinction in military service. He began copying the cuneiform inscriptions on the rock tablets at Behistun as far back as 1835. Mastering the old Persian character in these inscriptions, he found the key, by the aid of which the deciphering of the other cuneiform languages was achieved. The years 1844 and 1845 were specially devoted to this task, and in 1846 Rawlinson's first work on the cuneiform inscriptions was published. The next year he obtained complete copies of all the Behistun inscriptions, standing, to do the work, on a ladder placed on a shelf of rock jutting from the precipice three hundred feet above the plain. Since then he has been one of the foremost in furthering the work of decipherment he had so well begun.

M. JULES REGNAULD, Professor of the Paris Faculty of Medicine, has recently died, ninety years old.

DR. F. SCHMITZ, Professor of Botany at Greifswald, who died January 28th, was best known by his studies of algæ, and particularly of the red seaweeds, of which he added much to our knowledge of the life history. He published an account of the formation of auxospores in the diatoms in 1877, and a description of the green algæ of the Gulf of Athens in 1877.

THE Rev. J. Owen Dorsey, the ethnologist, who died in Washington February 5th, had been connected with the United States Bureau of Ethnology since 1877, and was President of the Anthropological Section of the American Association in 1893.

THE death is reported of Dr. Gerhard Krüss, Extraordinary Professor of Chemistry in the University of Munich. He was perhaps best known in connection with researches concerning the metals of the rare earths.

DR. D. HACK TUKE, editor of the Journal of Mental Science and President of the Medico-Psychological Association of Great Britain, died in London, March 5th, in the sixty-eighth year of his age. He was author of several standard works on mental diseases, including such subjects as Sleep-walking and Hypnotism, Insanity, Psychological Medicine, the Influence of the Mind on the Body, etc., and of several valuable essays for a Dictionary of Psychological Medicine.

GEORGE NEWBOLD LAWRENCE, one of the oldest and most eminent American ornithologists, died in this city, January 17th, aged ninety-five years. He was the contemporary of all American ornithologists, from Audubon and Nuttall down. The list of his published writings contains one hundred and twenty-one titles. The earliest appeared in 1844 and the latest in 1891. He was associated with Baird and Cassin in the authorship of Baird's work on the birds of North America, which was published in 1858. His special field was in tropical American birds, of which he described more than three hundred new species. One genus and twenty species were named in his honor.

THE Rev. T. P. Kirkman, a mathematician of considerable reputation, died February, 1895, eighty-eight years old.